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ABSTRACT

Reported are findings of a study involving 46 families in which the effect of the Feingold (additive free) diet on hyperactivity in preschool and elementary age children was investigated. Eleven sections cover the following project components: introduction (definition of hyperactivity and the B. Feingold hypothesis), methodology, demographic information, physical-neurological examination results, nutrient analysis, classroom and laboratory observations, reaction time, Continuous Performance Test results, neuropsychological tests, behavioral ratings, and the preschool sample. It is reported in a summary that with the possible exception of a small preschool sample on whom limited data could be obtained, the overall results did not provide convincing support for the efficacy of the experimental (Feingold) diet, and that the frequency with which favorable diet effects were judged to be present was highest in the subjective parent ratings, declined sharply in the teacher ratings, and essentially disappeared in the objective neuropsychological, classroom, and laboratory observational data. Included are charts, graphs, and tables with statistical data. (SBH)

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AN EXPERIMENTAL EVALUATION OF HYPERACTIVITY AND FOOD ADDITIVES[1]

1977 - PHASE I

Dr. J. Preston Harley, Dr. Lawrence Tomasi, Dr. Roberta Ray, Dr. Peter Eichman, Dr. Charles Matthews, Dr. Raymond Chun, Mr. Edwin Traisman, and Dr. Charles Cleeland.

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EC 104073

TABLE OF CONTENTS

PAGE

ACKNOWLEDGEMENTS xvii

SUMMARY. xxiii

SECTION I - INTRODUCTION

1.1 Hyperactivity - Definition 1
1.2 Feingold Hypothesis. 3

SECTION II - METHODOLOGY

2.1 Subject Selection. 13
2.2 Procedure. 14
2.3 Diets. 15
2.4 Dietary Compliance 16

SECTION III - DEMOGRAPHIC INFORMATION

3.1 Children's Personal Data Inventory 35
3.2 Children's Diagnostic Scale. 36
3.3 Children's Symptom History 36
3.4 Prior Medication 37

SECTION IV - PHYSICAL-NEUROLOGICAL EXAMINATION

4.1 Procedure. 61
4.2 Physical Evaluation. 61
4.3 Neurological Evaluation. 63
4.31 Preschool Sample 63
4.32 School-Age Sample. 64

SECTION V - NUTRIENT ANALYSIS

5.1 Introduction 81
5.2 Procedures 81
5.3 Nutrient Intake. 83
5.4 Vitamin C. 83
5.5 Carbohydrates. 85
5.6 Thiamin. 85
5.7 Recommended Daily Allowance. 86
5.8 Energy Consumption 87
5.9 Nutrients Contributed by Breakfast 87
5.10 Nutrients Contributed by Snacks. 88
5.11 Height and Weight Data 88

TABLE OF CONTENTS (Cont'd.)

PAGE

SECTION VI - CLASSROOM AND LABORATORY OBSERVATIONS

6.1 Introduction 103
6.2 Procedure for Classroom Observations 104
6.21 Subjects 104
6.22 Observation Setting. 105
6.23 Observation Code 105
6.24 Observers. 107
6.3 Results of Classroom Observations. 108
6.31 Design of Analysis 108
6.32 Comparison of Hyperactive and Control Subjects, Time Periods 108
6.33 Effects of Diet and Diet Sequence. 109
6.4 Procedure for Laboratory Task. 110
6.41 Subjects 110
6.42 Laboratory Task Setting. 110
6.43 Data from Laboratory Task. 111
6.44 Observers. 112
6.5 Results of the Laboratory Task 112
6.51 Comparison of Hyperactive and Control Groups 112
6.52 Comparison of Experimental and Control Diets 112

SECTION VII - REACTION TIME

7.1 Introduction 125
7.2 Procedure. 125
7.3 Results. 126

SECTION VIII - CONTINUOUS PERFORMANCE TEST (CPT)

8.1 Introduction 141
8.2 Procedure. 142
8.3 Results. 143
8.31 Dependent Variables. 143
8.32 Hyperactive Versus Control Subjects - Baseline 143
8.33 Control Versus Experimental Diet 143
8.34 Hyperactive Versus Control Subjects - Testings 144

TABLE OF CONTENTS (Cont'd.)

PAGE

SECTION IX - NEUROPSYCHOLOGICAL TESTS

9.1 Procedure 151
9.2 Rationale for Selection of Neuropsychological Variables . . 151
9.3 Wechsler Intelligence Scale for Children (WISC) 151
9.4 Wide Range Achievement Test (WRAT). 152
9.5 Finger Tapping Speed. 152
9.6 Maze or Kinetic Steadiness Test 152
9.7 Grooved Pegboard Test 152
9.8 Static Steadiness Test. 153
9.9 Knox Cube Test. 153
9.10 Porteus Maze. 153
9.11 Cognitive Style 154
9.12 Matching Familiar Figures (MFF) 155
9.13 Children's Embedded Figures Test (CEFT) 155
9.14 Psychological Examination Behavior Profile (PEBP) 156
9.15 Results 156

9.151 Neuropsychological Variables. 156
9.152 Psychological Exam Behavior Profile (PEBP). 158

SECTION X - BEHAVIORAL RATINGS

10.1 Introduction. 177
10.2 Conners Parent Questionnaire (PQ) 177
10.3 Conners Teacher Questionnaire (TQ). 178
10.4 Parent-Teacher Questionnaire (P-TQ) 178
10.5 Results 178

10.51 Conners P-TQ. 178
10.52 Teacher Questionnaire (TQ). 180

SECTION XI - PRESCHOOL SAMPLE

11.1 Introduction. 201
11.2 Results 201

11.21 Neuropsychological Variables. 201
11.22 Behavioral Ratings. 201
11.23 Laboratory Observations 202

11.3 Summary 202

LIST OF TABLES

PAGE

SECTION II - METHODOLOGY

2.0 Criteria for Subject Selection 19

2.1 School-Age and Preschool Subject Characteristics and Initial Mean P-TQ Ratings for Each Diet Sequence Group 20

2.2 Project Design 21

2.3 Examples of Food and Other Items Proscribed by the Experimental and Control Diets 22

2.4 Frequence and Mean of Weekly Individual Dietary Infractions for the School-Age Children During the Experimental Diet for Each Diet Order. 23

2.5 Frequency and Mean of Weekly Individual Dietary Infractions for the School-Age Children During the Control Diet for Each Diet Order 24

2.6 Summary of Dietary Infractions for the School-Age Children During the Experimental and Control Diets for Each Diet Order. 25

2.7 Summary of Dietary Infractions for the Preschool Children During the Experimental and Control Diets for Each Diet Order. 26

SECTION III - DEMOGRAPHIC INFORMATION

3.0 Children's Personal Data Inventory (CPDI). 39

3.1 Parents' Mean Age of School-Age and Preschool Experimental and School-Age Control Groups. 41

3.2 Developmental History. 42

3.3 Children's Symptom History (CSH) 43

3.4 Children's Symptom History for School-Age Experimental and Control Groups 44

3.5 Children's Symptom History of Experimental Preschool Group . 45

3.6 Medication History for School-Age Children 46

3.7 Medication History Immediately Prior to Project Participation 47

SECTION IV - PHYSICAL-NEUROLOGICAL EXAMINATION

4.0 Deviant Electroencephalogram (EEG) Records for the School-Age and Preschool Groups 67

4.1 Hematology and Urine Laboratory Results for the School-Age and Preschool Groups 68

4.2 Derived Means of Soft Neurological Signs for the School-Age Group. 70

LIST OF TABLES (Cont'd.)

PAGE

SECTION V - NUTRIENT ANALYSIS

5.0 Mean, Standard Deviations, and Ranges of Nutrients for Each Dietary Condition 91

5.1 Group Percentage of Standard Deviation for Dietary Periods Versus RDA Guidelines. 92

5.2 Distribution of Subjects Meeting RDA Levels During the Three Diet Periods 93

5.3 Percentage of Caloric Distribution from Protein, Carbohydrate, and Fat. 94

5.4 Percentage Contribution of Breakfast to the Total Intake and to the RDA Standard Deviation for the Group During Each Diet Period 95

5.5 Group Means for Calories, Protein, Fat, and CHO Composition of Snacks and Average Frequency of Snacks per Week During Each Diet Period. 96

5.6 Mean Percentage of Average Daily Nutrient Intakes Contributed by Snacks. 97

5.7 Prestudy and Poststudy Weights of the School-Age Group 98

5.8 Expected Weight for Height of Subjects Based on Baseline Heights and Weight Measures. 99

SECTION VI - CLASSROOM AND LABORATORY OBSERVATIONS

6.0 Means and Standard Deviations of Observation Code Categories for Hyperactive and Control Subjects During Three Observation Periods. 115

6.1 Means and Standard Deviations of Observation Code Categories for Hyperactive Subjects by Diet Sequence Assignment for Experimental and Control Diets 116

6.2 Means and Standard Deviations of Laboratory Observation Categories for Hyperactive and Control Subjects. 118

6.3 Means and Standard Deviations of Laboratory Observation Categories for Hyperactive Subjects for Experimental and Control Diets. 119

SECTION VII - REACTION TIME

7.0 Means and Standard Deviations of RT Latencies (Sec.) for the School-Age Hyperactive Group for the Experimental and Control Diet: Treatment by Choice Condition 132

7.1 Number and Percentage of Failures to Respond Within the Three Second Response Interval for Each RT Choice Condition. 137

SECTION VIII - CONTINUOUS PERFORMANCE TEST (CPT)

8.0 Continuous Performance Test Scores for Hyperactive and Control School-Age Subjects at Baseline. 145

LIST OF TABLES (Cont'd.)

PAGE

8.1 Summary of Analysis of Variance for Continuous Performance Test Measures for Hyperactive School-Age Subjects (N=36) for Experimental and Control Diet 146

8.2 Means and Standard Deviations of the Continuous Performance Test Dependent Variables for the Hyperactive Subjects Receiving the Experimental/Control Diet Sequence and the Control Group 147

8.3 Means and Standard Deviations of the Continuous Performance Test Dependent Variables for the Hyperactive Subjects Receiving the Control/Experimental Diet Sequence and the Control Group 148

SECTION IX - NEUROPSYCHOLOGICAL TESTS

9.0 Results of t-Tests for the Neuropsychological Variables: School-Age Hyperactive Versus Control Subjects at Baseline. 159

9.1 Hyperactive Versus Control School-Age Subjects at Baseline for the Matching Familiar Figures Test. 160

9.2 Correct Responses for the Children's Embedded Figures Test for the Hyperactive Versus Control School-Age Subjects at Baseline. 161

9.3 Results of ANOVAs for Neuropsychological Tests for the School-Age Hyperactive Subjects for the Experimental and Control Diet Conditions. 162

9.4 Summary of ANOVAs for Correct Responses on the Children's Embedded Figure Test by Diet Order for the School-Age Hyperactive Subjects. 163

9.5 Results of ANOVAs on the Neuropsychological Tests for the School-Age Hyperactive Children Receiving the Experimental-Control Diet Sequence and Control Subjects for the Three Testings. 164

9.6 Results of ANOVAs on the Neuropsychological Tests for the School-Age Hyperactive Children Receiving the Control-Experimental Diet Sequence and Control Subjects for the Three Testings. 165

9.7 Means, Standard Deviations and t-Tests for the Hyperactive Versus Control School-Age Subjects at Baseline for the PEBP Variables 166

SECTION X - BEHAVIORAL RATING SCALES

10.0 Summary Table of the ANOVAs of the Conners Parent-Teacher Questionnaire Scores for the School-Age Hyperactive Subjects. 182

10.1 Means and Standard Deviations of the Conners P-TQ ratings by Mother, Father, and Teacher by Diet Order for the School-Age Hyperactive Group 183

LIST OF TABLES (Cont'd.)

PAGE

SECTION X - BEHAVIORAL RATING SCALES (Cont'd.)

10.2 Summary of t-Tests of the Conners Teacher Questionnaire Scores for the School-Age Hyperactive Group Versus the Matched Controls at Baseline 184

10.3 Summary of ANOVAs of the Conners Teacher Questionnaire for Experimental Versus Control Diets for the School-Age Hyperactive Subjects 185

10.4 Summary of Conners Teacher Questionnaire Factor Scores for the School-Age Hyperactive Group Receiving the Diet Sequence EXP/CNT and for the Control Group. 186

10.5 Summary of Conners Teacher Questionnaire Factor Scores for the School-Age Hyperactive Group Receiving the Diet Sequence CNT/EXP and for the Control Group. 187

SECTION XI - PRESCHOOL SAMPLE

11.0 Preschool Age Sample P-TQ Selection Criteria 203

11.1 Summary of Neuropsychological Tests for Preschool Age Hyperactive Subjects for Baseline, Experimental and Control Diet Conditions 204

11.2 Summary of Mother and Father P-TQ Ratings for Experimental and Control Diet Conditions by Diet Order for the Preschool Age Sample 207

LIST OF FIGURES

PAGE

SECTION IV - PHYSICAL-NEUROLOGICAL EXAMINATION

4.0 Neurological Examination Information for School-Age Group 69

SECTION VI - CLASSROOM AND LABORATORY OBSERVATIONS

6.0 Schematic of Laboratory Observation Room. 117

SECTION VII - REACTION TIME

7.0 Illustration of Subject Seated at Continuous Performance Test and Reaction Time Tasks. 129

7.1 Mean RT Latency Across Trial Blocks by Choice for the Hyperactive Subjects at Baseline. 130

7.2 Mean RT Latency Across Trial Blocks by Choice Condition for the Control Subjects at Baseline. 131

7.3 Mean RT Latency Across Trial Blocks by the Choice Conditions for the Control-Experimental Diet Order Group and the Control Subjects for the First Evaluation 133

7.4 Mean RT Latency Across Trial Blocks by the Choice Conditions for the Control-Experimental Diet Order Group and the Control Subjects for the Second Evaluation. 134

7.5 Mean RT Latency Across Trial Blocks by the Choice Conditions for the Control-Experimental Diet Order Group and the Control Subjects for the Third Evaluation 135

7.6 Mean RT Latency Across Trial Blocks by the Choice Conditions for the Experimental-Control Diet Order Group and the Control Subjects. 136

SECTION X - BEHAVIORAL RATING SCALES

10.0 Mother, Father and Teacher Conners P-TQ Weekly Ratings for the Two Diet Sequences for the School-Age Hyperactive Subjects and the Average P-TQ Ratings for the 10 Control Subjects. . . . 181

SECTION XI - PRESCHOOL SAMPLE

11.0 Mother and Father P-TQ Weekly Ratings for the Experimental-Control Diet Sequence for the Preschool Age Hyperactive Subjects. 205

11.1 Mother and Father P-TQ Weekly Ratings for the Control-Experimental Diet Sequence for the Preschool Age Hyperactive Subjects. 206

LIST OF APPENDICES

PAGE

SECTION II - METHODOLOGY

Age Distribution of Experimental and Control School-Age Children . . 31
Age Distribution of Preschool Children 32
Experimental Diet - Suggested Menus. 33
Control Diet - Suggested Menus 34

SECTION III - DEMOGRAPHIC INFORMATION

Children's Personal Data Inventory 53
Children's Diagnostic Scale (CDS). 55
Children's Diagnostic Scale Classification for School-Age Children . 56
Children's Diagnostic Scale Classification for Preschool Children. . 57
Children's Symptom History Cluster Listing 58

SECTION IV - PHYSICAL-NEUROLOGICAL EXAMINATION

Physical and Neurological Examination for Soft Signs 75

SECTION IX - NEUROPSYCHOLOGICAL TESTS

Items of the Psychological Examination Behavior Profile (PEBP) . . . 173

SECTION X - BEHAVIORAL RATING SCALES

Conners Parent Questionnaire 193
Conners Parent Questionnaire Factor Composition. 196
Conners Teacher Questionnaire. 197
Conners Teacher Questionnaire Factor Composition 198
Conners Parent-Teacher Questionnaire 199

LIST OF ABBREVIATIONS

ANOVA - Analysis of Variance
CDS - Children's Diagnostic Scale
CEFT - Children's Embedded Figures Test
CHO - Carbohydrates
CNT - Control
CPDI - Children's Personal Data Inventory
CPT - Continuous Performance Test
CSH - Children's Symptom History
ECDEU - Early Clinical Drug Evaluation
EEG - Electroencephalogram
EXP - Experimental
HCT - Hematocrit
HGB - Hemoglobin
ICGH - Interagency Collaborative Group on Hyperkinesis
IQ - Intelligence Quotient
K-P - Kaiser Permanente
$\overline{X}$ - Mean
MFF - Matching Familiar Figures
N - Number
PANESS - Physical and Neurological Examination for Soft Signs
Pb - Lead
PEBP - Psychological Examination Behavior Profile
PQ - Parent Questionnaire
P-TQ - Parent-Teacher Questionnaire
RDA - Recommended Dietary Allowance
RT - Reaction Time
S - Subject
SD - Standard Deviation
Σ - Sum
TQ - Teacher Questionnaire
USDA - United States Department of Agriculture
WBC - White Blood Count
WISC - Wechsler Intelligence Scale for Children
WRAT - Wide Range Achievement Test

ACKNOWLEDGEMENTS

The study reported in this monograph required the total commitment of 46 families to accept a number of dramatic changes in many aspects of their life styles for a period up to three months. The commitment applied not only to the child in the study, but to the entire family and included major alterations in the families' food preparation, habits, consumption-patterns, menu selection, and careful restriction of medications. In addition, the parents had to participate in several lengthy interviews, and each parent was asked to complete weekly ratings on his/her child's behavior. Each child was repeatedly tested throughout the study in a number of laboratory and clinical settings and was observed in the classroom. Each family made, at considerable personal inconvenience, multiple trips to the Psychology Building, to the Neurological and Rehabilitation Hospital, and to the Waisman Center at the University of Wisconsin for interviews, observation and test appointments. Any family who participated in our study is unlikely ever to forget the experience. We cannot adequately express our gratitude to them.

Because our experimental design called for the employment of a control group, we also studied a nonhyperactive group of children in the same classroom with the hyperactive child and obtained the same lengthy examination, observational and parent-teacher rating data on them as we did on the experimental subjects. For the experimental subjects, food for the entire family was provided by the project throughout the study. The control parents and their families were not given food or any other tangible incentive. The control families

were simply good and giving and interested enough to subject themselves to the tedious series of tests and interviews and ratings obtained on the experimental families. The identity of the control subjects and their families must remain by experimental-research convention anonymous; in personal terms they are individually and warmly acknowledged and thanked by our research team.

Classroom teacher cooperation and effort were also essential for us to conduct this study. The classroom teachers of the experimental and control children agreed to complete on a weekly basis a behavioral check-list and rating form for each child. In addition, they were sufficiently secure and gracious to admit independent behavioral observers into their classrooms several times a week in order to make objective tallies of inattentive, out-of-seat, distracting, and other behaviors. All of this was a major imposition on the teachers' already hectic and demanding day, and we are most appreciative of their crucial contribution to the project.

A note of thanks must also be given to the administrators and research division staff of the Madison Public Schools and to the other Madison area school administrators for granting us permission to go into the classroom. As is well known, administering a school program which is in close proximity to a major university presents unusual demands upon staff and students. Such school systems typically are flooded with requests from university researchers to study their children. Were all, or even a majority of such research requests to be met, the children could spend the entire day being observed, tested, probed, sampled, and interviewed. The Madison Public School Research Division has a well developed eye and ear for investigative trivia, and they are very selective regarding the numbers and kinds of research projects they permit to be

conducted with their students and staff. We thank them for finding our study of sufficient merit to grant us that permission.

Finally, we express our gratitude to the Food Research Institute of the University of Wisconsin, Madison for funding this project. These are cynical, indeed paranoid times, and the fact that the Food Research Institute administers food safety research projects that are supported in part with funds given to the university by various food industries could conceivably prompt the following accusatory and/or dismissive syllogism; namely that our results (unless unequivocally in support of an "anti-food industry" position) are necessarily suspect if not worthless since it is obvious that neither the investigators nor the Food Research Institute are going to report findings which might jeopardize continuing financial support by food companies which would have a vested economic interest in the experimental results.

Mounting a sustained or outraged defense against such accusations would invest the charges with more dignity and credence than they deserve. Suffice it to say that the Food Research Institute has a long and well documented history of dedication to the objective scientific investigation of foods and their relationship to public health and safety. The project research team, as far as we have been able to ascertain short of individual stock holding disclosures under oath, is equally void of vested interests, and is committed only to the reporting of our findings as fully and fairly as we are able.

We have made several references to the research "team". Who are they and why did they wish to get involved in this project? The Department of Neurology at the University of Wisconsin has a long-standing interest in the etiology and academic-social implications of minimal

cerebral dysfunction and learning disabilities in children. Dr. Peter Eichman, one of the three neurologists on the team, was part of an earlier University of Wisconsin investigation on the effects upon later cognitive-social development of perinatal insult to the central nervous system. Dr. Raymond Chun is the Head of the Pediatric Neurology Section at University Hospital and an experienced clinician and investigator. Dr. Lawrence Tomasi, who is currently associated with Children's Memorial Hospital, Division of Pediatric Neurology, Northwestern University, Chicago, performed the neurological examinations on the children in the study. Another team member is Dr. Roberta Ray from the University of Wisconsin Psychology Department, who was in charge of the classroom and laboratory observation aspects of the study. Drs. Matthews, Cleeland, and Harley are in the Neuropsychology Section of the Department of Neurology. From the time the Neuropsychology Laboratory opened in 1962, approximately four thousand children with major presenting problems of known or suspected cerebral dysfunction, minimal brain damage, learning disabilities, and/or hyperkinetic syndrome have been evaluated with many of the assessment techniques used in this project. The target population and the clinical hypothesis to be tested was therefore entirely in accordance with the Neuropsychology Laboratory's clinical and research interests, and its involvement was in this sense inevitable.

Input from the Department of Food Microbiology and Toxicology came from Edwin Traisman, Program Administrator, who was active in the planning, organization and functioning of the project.

Subsequent sections of the monograph describe in detail the extremely complex and demanding day-to-day logistics involved in collecting the data base generated by a project of this magnitude, including multiple sources

of parent-teacher ratings information, classroom and laboratory observational data, neuropsychological measures of attention, concentration, and determination of nutritional status and degree of dietary compliance. Such a project cannot be implemented or executed without the help and dedication of a number of individuals whose efforts were crucial to each phase of the study. Classroom and observational data were collected and supervised by M. A. Kantosky, R. L. Clement, and E. Morse. Neuropsychological test results were obtained by Sheila Waltz, Nancy Renga, Jean Moss, Sue Cole, Tess Smith, Randall Daut, Lynn Meyer, and Kathy Soper. Parent and child scheduling was handled by Elizabeth Betka. Mary-Lynn Mason, R.D. and Ruth Marion were responsible for the dietary aspects of the project. Nutritional analysis of the control and experimental diets was conducted by Jean Densmore. Mr. Larry Reske, Manager of Sentry Foods of Middleton, was responsible for the cheerful and conscientious delivery of required food items to the families in the project. Ms. Peggy Dewey, President of the Madison Learning Disabilities Association, kindly brought our proposed study to the attention of many parents, which contributed significantly to our subject pool.

The frequent revisions and recompositions of the manuscript and tables, as well as the final typing of the monograph, were cheerfully and competently performed by Ms. Bonnie Lancaster.

SUMMARY

With the possible exception of a small preschool sample on whom only limited data could be obtained, the overall results do not provide convincing support for the efficacy of the experimental (Feingold) diet. The frequency with which favorable diet effects were judged to be present was highest in the subjective parent ratings, declined sharply in the teacher ratings (Conners, 1973; Werry and Sprague, 1974), and essentially disappeared in the objective neuropsychological, classroom, and laboratory observational data. The few significant findings related to diet that did emerge must be conservatively interpreted for several reasons.

Given the very large number of statistical tests conducted, some differences obtained may be due to chance alone. Positive effects of the diet were primarily restricted to the sequence of control diet first--experimental diet second; a diet order effect which has been observed in another investigation of the Feingold hypothesis (Conners, et al., 1976; Sprague, 1976). Although no satisfactory explanation is readily apparent, this finding may in part be referrable to a recent study (Werry and Sprague, 1974) reporting that rating scale data of this kind are unstable over time, with subsequent parental ratings showing a decline in degree of judged hyperactivity vis-a-vis their pretest or pretreatment ratings of the children. Whatever the reason, the fact that the experimental diet seems to "work" only when a control diet is given first would appear to diminish the claimed efficacy of the experimental diet.

While there may well exist a subset of hyperactive children whose behavior is adversely affected by artificial food colors, the results of the present study of boys age 6-12 suggest that such a subset is either very small and/or that the relationship of diet manipulation to behavioral change is much less dramatic and predictable than has been described in anecdotal-clinical reports (Feingold, 1975).

The attentive reader of this report will undoubtedly sense, if not specifically identify, our discomfort with the uncertainty in the manner of presenting the results on the preschool sample. We have chosen to emphasize the findings on the school-age sample because we believe our experimental design for this group meets our intended criteria with respect to sufficient number of subjects, employment of selection methods clearly appropriate for this age sample, and the availability of multiple sources of objective data regarding changes in hyperactive behaviors.

We have been unwilling to grant equal credence or weighting to the parental rating scale data generated by the preschool parents for several reasons: first, the sample of only 10 preschoolers versus the larger group of 36 school-age subjects and the unavailability of teacher rating data on the same subjects; second, the failure to find parallel changes in neuropsychological test scores or in grid room observational measurements; third, the fact that Conners' P-T Questionnaire was employed as one criterion for subject selection despite the fact that the scale was developed for and validated upon school-age children. (We were aware at the onset of the study that the Conners' scale might not be entirely appropriate for the preschool sample, but demonstrably better behavioral rating scales were to the best of our knowledge, not available. For this reason and to maintain uniformity in our experimental procedure, we

elected to utilize the Conners' rating scale.) Finally, the well-recognized difficulty of establishing firm and unequivocal criteria for the diagnosis and/or measurement of hyperactivity in preschool as opposed to school-age subjects (Ross and Ross, 1976; NIMH Conference, 1976) is another source of concern. Nevertheless, objectivity and completeness in reporting our data require us to underscore our finding that 10 of 10 mothers and 4 of 7 fathers of the preschool sample rated their children as improved on the experimental (K-P) diet. Further, unlike the school-age boys, the favorable parental ratings occurred regardless of which diet the child received first. While we feel confident that the cause-effect relationship asserted by Feingold is seriously overstated with respect to school-age children, we are not in a position to refute his claims regarding the possible causative effect played by artifical food colors in preschool children. For this reason, studies using large numbers of preschool age subjects with objective outcome measures are indicated before a final comprehensive summary statement can be justified.

The ICGH Committee (1976) has recommended a two-stage research strategy to investigate the Feingold hypothesis; the first of which was to establish the efficacy, if any, of the K-P diet by comparing the behavior of hyperactive children under K-P and control diet conditions. The present report represents our findings from the stage one phase of the recommended protocol. The second strategy suggested by the committee was to use those children who had shown the best response to the diet manipulation in the initial study in a subsequent challenge study in which the child serves as his own control and is repeatedly challenged by food substances containing specified amounts and kinds of artificial food colors and/or flavors. We are now nearing completion of stage two

of this project, having placed a small group of children selected from the present study on the K-P diet and using challenge (artificial food color mixtures) versus placebo materials in a double-blind multiple crossover sequence. The results of this pending study and those of other investigators in the United States (Conners and Goyette, 1977), Canada (Williams, et al., 1976), and Australia (F. Levy, personal communication, May 12, 1977) who are conducting similar challenge studies may provide a sufficiently diversified data base to permit unequivocal conclusions to be offered regarding the role played by artificial food colors in the development and/or maintenance of hyperactive behavior in children. In view of the greater suggested response of younger than of older children to dietary manipulation in our study, prospective investigations of either a "first" or "second" stage nature should emphasize the collection of a greater number and range of observational, laboratory, and rating scale data on preschool children than was available to the Wisconsin investigative team. These caveats and expressions of dissatisfaction with the technical shortcomings of our preschool study, however, must not obscure nor detract from our generally negative and nonsupportive findings with regard to Feingold's assertions regarding the efficacy of his diet for the reduction of hyperactive behavior in school-age boys.

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SECTION I - Introduction

1.1 Hyperactivity-Definition

Sustained motor activity, short-attention span, poor impulse control, easy distractibility, and poor tolerance to frustration are usually considered cardinal features of hyperactive children (Cantwell, 1975). Depending upon the diagnostic criteria employed, prevalence estimates of "hyperactivity" range from approximately five to ten percent (Wender, 1971). Studies suggest that some hyperactive children continue to have significant psychological/social problems into adulthood and do not outgrow their "hyperactivity" (Anderson and Plymate, 1962; Minde, 1971; Laufer and Denhoff, 1957; Menkes, Rowe and Menkes, 1967). The ratio of males to females has been reported to be from 4:1 (Paine, 1962) to as high as 9:1 (Werry, 1968). Clinicians and researchers have repeatedly emphasized the etiological heterogeneity of children categorized as "hyperactive" and the absence of unambiguous symptomatology for making a diagnosis of hyperactivity, hyperkinetic reaction, learning disabled (LD) or minimal brain dysfunction (MBD). In the past decade, an increasing number of investigations have dealt with this poorly understood, indeed promiscuously labeled group of children. The Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-II) defines hyperkinetic reaction of childhood as follows: "This disorder is characterized by over-activity, restlessness, distractibility, and short attention span, especially in young children; the behavior usually diminishes in adolescence. If this behavior is caused by organic brain damage, it should be diagnosed under the appropriate nonpsychotic organic brain syndrome (q.v.)." Recently the emphasis has shifted from consider-

ation of hyperactivity or gross motor activity per se to consideration of an attentional deficit as the key component of this disorder. The etiology of hyperkinesis has been ascribed to a broad range of factors including, but by no means limited to perinatal, psychological, sociological, environmental, imbalance of neurotransmitters and genetic conditions (Safer and Allen, 1976). A comprehensive bibliography of articles pertaining to hyperactivity has been compiled by Kirson (1976). Psychopharmacological therapy for hyperactivity has included: stimulant medications such as methylphenidate and dextroamphetamine (Millichap and Fowler, 1967; Eisenberg and Conners, 1971; O'Malley and Eisenberg, 1973), magnesium pemoline (Conners, 1972; Millichap, 1973), Tricyclic antidepressants (Rapoport, et al., 1974), anticonvulsants (Conners, 1972), caffeine (Conners, 1975) and imipramine (Greenberg, 1975). The use of psychotrophic medications (stimulants, tranquilizers, antidepressants and anticonvulsant drugs) in the treatment of children with behavior disorders has been reviewed by Conners (1972).

Behavioral interventions in the classroom and at home, individual psychotherapy and role playing represent other approaches, many times combined with medication therapy, for treating hyperactive children (Ross and Ross, 1976).

Additional treatment procedures which have been investigated include caffeine (Conners, 1975; Garfinkel, Webster and Sloman, 1975), megavitamins (Cott, 1972; Hoffer, 1974), changing fluorescent lighting conditions (Ott, 1976), and the identification and amelioration of allergies (Wunderlich, 1973). Also, food allergies have been purported to be responsible for symptoms of aggression, irritability and hyperactivity (Baldwin, Kittler and Ramsay, 1968; Moyer, 1975; Randolph, 1947).

Evidence for the efficacy of these various treatment strategies is in general questionable due to the failure to employe rigorous experimertal designs. Articles by Conners (1971), and Werry and Sprague (1972) provide an excellent review and discussion of critical/minimal methodological criteria necessary for studies attempting to assess changes as a consequence of a particular treatment.

1.2 Feingold Hypothesis

At the 1973 annual meeting of the American Medical Association, Dr. Ben Feingold asserted that the ingestion of "low-molecular weight chemicals" (including salicylates and artificial food colors and flavors) is an important factor in the development and maintenance of hyperactivity in children (Feingold, et al., 1973). Dr. Ben Feingold is Chief Emeritus, Department of Allergy, Kaiser-Permanente Medical Center, San Francisco; his suggested additive-free diet is thus commonly referred to as the Kaiser-Permanente (K-P) diet. Feingold has correlated the increasing consumption of food additives over the past decade with the reported rising incidence of hyperkinetic-learning disabled children and has implied a causal relationship. These claims were widely reported by the press and were subsequently inserted into the Congressional Record (Beall, 1973). However, diet histories obtained from questionnaires completed by parents of hyperactive and control subjects in a study by Palmer, et al., (1975) failed to demonstrate noteworthy differences in amount of intake of food additives, nor were significant differences found between subgroups on and off medication (methylphenidate or imipramine).

An investigation of the Feingold hypothesis conducted in Australia has reported a significant improvement in behavior of hyperactive children following four weeks on the K-P diet (Salzman, 1976). Prior to placing the children on the diet, the parents were informed of the anticipated effects of the K-P diet upon their child's behavior and were told "if the diet was going to have an effect, they would see the results within four weeks, and if the child violated the diet his behavior would return to the pre-diet condition within two to four hours and could remain that way for up to ninety-six hours."

In this Australian study, thirty-one patients who had failed to respond to behavior modification therapy were given an allergy test (Hawley and Buckley, 1974) for artificial colors. Fifteen of the eighteen patients had positive responses and were placed on the K-P diet. Behavior of the children was assessed by a 49-category behavior questionnaire completed by the child's mother. The absence of diet monitoring, unclear sample description, lack of a control group or diet crossovers or the employment of a "blind" procedure, inadequate consideration of placebo effects and the failure to us a standardized validated rating scale, introduce alternate possible explanations of the childrens's "favorable" response to the K-P diet (Werry, 1976).

In another experiment (Conners, et al., 1976), nine male hyperactive children were placed on the K-P diet for four weeks and were then given four weeks of a control diet. Six other subjects received the opposite diet sequence. The participating families were given lists of food items permitted under each of the diet conditions. The control diet was arranged to have shopping, preparation, and monitoring demands comparable with the K-P diet. Whether the procedures/safeguards of the Conners

study were sufficient to prevent diet identification and possible biasing of the subjective ratings was questioned by Levine and Linden (1976). A statistically significant reduction was found on the teacher but not on the parent ratings in favor of the K-P diet. However, re-analysis of these same data by Sprague demonstrated a pronounced interaction of diet and diet order. Sprague (1976) suggested that, "the strongest statement that should be made is that the K-P diet did improve teacher ratings in only the group which received the control diet first and the K-P diet second".

Feingold (1975) has advocated the removal of all foods containing synthetic food additives from federally supported food programs and has suggested the use of a logo to identify food products that do not contain synthetic food colors or flavors. Because of the major implications of his assertions and recommendations for the public and the food industry, the Nutrition Foundation, in 1975, assembled a committee of fourteen medical, food, and behavioral scientists to conduct a systematic review of evidence on this subject. The National Advisory Committee report (1976) to the Nutrition Foundation included the following conclusions:

1) Controlled studies have not shown that hyperkinesis is related to the ingestion of food colors;

2) A significant reduction of hyperactive behaviors when children are placed on the K-P diet has not been experimentally demonstrated; and,

3) The diet should be used only with competent medical supervision.

A second panel of experts was brought together by the Food and Drug Administration (Albert C. Kolbye, Chairman) in July, 1975, to form the Interagency Collaborative Group on Hyperkinesis (ICGH). A preliminary

report (1976) from the ICGH stated that studies to date "have neither proven nor disproven the hypothesis that a diet free of artificial food colors and flavors reduces the symptoms in a significant number of children with the hyperkinetic behavior syndrome." However, the report further noted that "the evidence taken as a whole is sufficient to merit further investigation into the relationship of diet and the hyperkinetic syndrome."

Prompted by the controversy just described and following the research design suggestions of these two interdisciplinary groups, we initiated the first double-blind crossover study of the Feingold hypothesis to obtain objective laboratory and classroom observational data, in addition to subjective parent-teacher ratings on hyperactive children under control and experimental diet conditions.

Members of the Wisconsin project investigating the Feingold hypothesis initially presented our research protocol for review and critique at the 1974 Annual Food Research Institute meeting, held in Chicago, discussed the design in a special meeting with Dr. Feingold in Chicago in October, 1974, and presented the general outline of our proposed project at the initial meeting of the National Advisory Committee on Hyperkinesis and Food Additives, January 12-14, 1975, Glen Cove, Long Island. Finally, we began collecting data at the end of January 1975.

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SECTION II - Methodology

2.1 Subject Selection

Subjects (S's) were selected from male children residing within the general Madison vicinity referred to our hospital for evaluation of "hyperactivity". Local pediatricians and physicians were contacted to request referral of additional possible S's.

Children selected for inclusion in the study had to meet at least two of the three criteria for hyperactivity (Table 2.0); first, a score of 20 or greater on the Conners Parent-Teacher Questionnaire (P-TQ), indicative of moderate-severe behavioral disruption primarily associated with hyperactivity (Conners, 1970) as rated by at least one parent; secondly, a score of 20 or greater as rated by the child's teacher (Appendix X); finally, if the child was given a rating of less than 20 by either source, a primary diagnosis (DSM II - 308.0) of hyperkinetic reaction by the child's physician was required to fulfill the selection criteria. Children with a history of unequivocal neurological disease and/or brain damage, psychopathology, convulsive disorders, or an IQ below 85 were not accepted as project participants. Descriptive characteristics of the two diet order groups (e.g., experimental-control and control-experimental) for the school and preschool samples are shown in Table 2.1. The diet order groups are comparable in terms of initial P-TQ ratings from the childrens' parents and teachers, diagnoses of hyperactivity, medication status at study onset and IQ for the school-age group. The two diet subgroups in the preschool sample are likewise comparable, with the exception of a relatively high mean IQ in the diet sequence group which received the experimental diet first. This was

primarily the results of an exceptionally high score (FSIQ = 151) by one child.

2.2 Procedure

The project was divided into three phases: spring (N=10), summer (N=10), and fall (N=36) of 1975. Children between the ages of 6 years, 0 months and 12 years, 11 months ($\bar{X}$ = 114.9 months, SD = 21.8) were included in the spring and fall samples. Preschool age boys between the ages of 3 years, 0 months and 5 years, 11 months ($\bar{X}$ = 56 months, SD = 13.6) were studied in the summer sample. In the fall phase, a group of 12 control, nonhyperactive S's ($\bar{X}$ = 110.7 months, SD = 21.4) received the same series of tests and parent-teacher ratings as did the 26 experimental Ss, but without diet intervention. The mean age of the school-age S's was equal for each diet order and was also equal to that of the control group. (See Appendix II for age distributions for the school-age experimental and control S's and preschool children).

Following an initial standardized interview and a two-week baseline period, S's were randomly assigned either to the experimental (Feingold-KP diet) or to the control diet. Examples of typical menus for the experimental and control diets are given in Appendix II. Assignments to the diet conditions were made by the project dietitian (Mary-Lynne Mason, R.D.); the medical/psychological team members, classroom/grid room observers, parents, and teachers did not know which diet a particular child was receiving, i.e., a double-blind procedure. Medications for controlling hyperactivity were terminated two weeks prior to baseline. In the spring and summer, Ss were on each diet for three weeks. For the fall group, the two diets were in effect for four weeks each

(Table 2.2). Diet order was counterbalanced for each of the three samples.

Three major evaluations were made on each S in addition to a neurological-physical examination. At the end of the two-week baseline interval, neuropsychological data, classroom and laboratory observations and behavioral ratings were obtained. Laboratory behavioral observations and neuropsychological measurements were repeated at the end of each diet period. Behavioral ratings using the Conners P-TQ were made weekly by the child's parents and teachers during the entire study. An average of three classroom observations per week were obtained throughout the study.

2.3 Diets

In the experimental diet, naturally occurring and added salicylates, synthetic food dyes, and artificial flavors were eliminated, following the diet as outlined by Feingold (1975). Ingredient labeling was used to determine which foods contained artificial flavors and/or colors. In those cases when labeling was not indicated, industry practice was considered. For example, cheddar cheese is generally colored with annatto, an extract from a tropical seed. Process cheese may be colored with one or more certified food colors. Hence, the experimental diet contained only natural cheese. Table 2.3 presents examples of foods claimed by Feingold to contain salicylates and also lists examples of other substances proscribed by his diet and therefore not used in the present study.

Test performed at the Food Research Institute, Madison (Ashoor and Chun, 1976) for salicylic acid and salicylate esters by thin layer chromatography with a 0.2 µg. sensitivity was negative for tangelos, grapefruits, lemons, oranges, strawberries, and almonds.

Ordinary levels of synthetic food dyes, food colorings, and salicylates were present in the control diet. The two diets were designed to be comparable in appearance, variety, nutritional value, and palatability. Because of an earlier (Conners, et al., 1976) expressed concern that the K-P diet may be deficient in Vitamin C, all the children were administered 50 mg. of Vitamin C daily during the experimental and control diets.

2.4 Dietary Compliance

Several steps were taken to maximize dietary compliance, an obvious critical factor. First, all the authors met with the participating families in a general meeting, and while the importance of compliance was stressed, the families were informed that certain infractions of the prescribed diet would undoubtedly occur, and such infractions should be carefully documented and reported. Secondly, the dietitian and her assistant made initial individual home visits to ascertain family eating habits and to reinforce the importance of compliance and instruct the parents in maintaining dietary records. Finally, arrangements were made to have all previously purchased foods removed from the house and to have each family's entire food supplies delivered to their homes weekly. The entire family was placed on the diet to minimize the possible treatment effects related to the experimental S and his "special" diet and also to reduce his temptation to eat other food that would ordinarily be available to "non-involved" family members. The weekly food deliveries also contributed to the blind aspect of the project since families were informed they would be on various diets over a six to eight week period, and were not told they would be on "one of two" diets. In addition to providing the

family's ordinary food needs, supplementary food was delivered for special occasions such as holidays, guests, family dinners, etc. At school, children customarily provide treats or snacks for their classmates on their birthdays. To avoid diet disruption in these situations, we made arrangements to deliver approved treats to the entire class when any child in the room had a birthday. Several other procedures were included to obscure the diet manipulations. Special production runs were made to prepare identically packaged chocolate bars and specialty cakes, with one containing standard ingredients and the other free of artificial flavors or colors.[1] The production and coding of these specially prepared food items was directly supervised by one of the research team members (E. Traisman). A number of pseudo-dietary manipulations and distractions were incorporated into the diets. For example, the family might be provided with hot dogs, potato chips, and cookies one week, and these items would be absent from the next week's menu. This might be interpreted by the child and/or his parents as evidence of being on two distinct diets, but these items (depending on brand selection) were permitted on both the control and experimental diets. Finally, sweet potatoes were systematically introduced and removed throughout the dietary phase as another pseudo-manipulation distracting technique.

At the conclusion of each diet week the dietitian visited the S's home to review the dietary records, give menu suggestions (Appendix II), inspect the kitchen for removal of particular food items not permitted for the coming week, and help maintain motivation for observing the dietary conditions. Reports from parents and teachers indicate that the school-age children were quite conscientious in maintaining strict

[1]We wish to thank the Nestle Company, White Plains, New York, and its ITT Continental Baking Company, Pye, New York for their generous agreement to help with this aspect of the project.

adherence to the diet program. The number of dietary infractions for each child during the experimental diet is shown in Table 2.4. Table 2.5 presents parallel information for the control diet period.

Tables 2.6 and 2.7 summarize the dietary infraction data for the school-age and preschool children, respectively, during the experimental and control diets for each diet order.

Although dietary infractions occurred more frequently during the experimental than during the control diet periods, in both diet order sequences the median number of infractions per S during the experimental diet period were less than one per week. Detailed inspection of dietary infraction diaries of the S's showing the largest number of infractions while on the experimental diet (e.g., S #3, Table 2.4) showed no correspondence between diet infraction and any dependent variable data (rating scale, classroom observations, neuropsychological measures, etc.) obtained during the time period most closely following the recorded infraction.

Table 2.0 Criteria for Subject Selection

A. DIAGNOSIS: (2 OF 3)

1. TEACHER'S RATING ON CONNERS P-TQ $\geq$ 20

2. PARENT'S RATING ON CONNERS P-TQ $\geq$ 20

3. CHILD'S PHYSICIAN'S DIAGNOSIS OF HYPERKINETIC REACTION (DSM II - 308.0)

B. SEX: MALES ONLY

C. IQ: WISC IQ $\geq$ 85

D. AGE: 6 TO 12 (SCHOOL-AGE) 3 TO 6 (PRESCHOOL)

E. TREATMENT: HISTORY OF DRUG THERAPY FOR HYPERACTIVITY DOES NOT EXCLUDE S FROM POSSIBLE PARTICIPATION

F. MEDICAL EXAM: NO GROSS PHYSICAL OR "HARD" NEUROLOGICAL FINDINGS

G. PSYCHOLOGICAL EXAM: NO HISTORY OF PSYCHOPATHOLOGY

Table 2.1 School-Age and Preschool Subject Characteristics and Initial Mean P-TQ Ratings for Each Diet Sequence Group

		School-Age Children Diet Order			Preschool Children Diet Order		
		EXP-CNT (N=19)	CNT-EXP (N=17)	TOTAL (N=36)	EXP-CNT (N=5)	CNT-EXP (N=5)	TOTAL (N=10)
MOTHER P-TQ RATING	$\bar{X}$	22.05	23.78	23.61	24.20	21.40	22.80
	SD	5.62	2.80	2.90	3.90	2.97	3.58
TEACHER P-TQ RATING	$\bar{X}$	16.88	17.60	17.26			
	SD	4.20	4.14	4.07			
DIAGNOSED "HYPERACTIVE"	N	15	16	31	4	4	8
RECEIVING PSYCHOTROPIC MEDICATION	N	9	9	18	1	0	1
VERBAL IQ	$\bar{X}$	102.41	101.89	102.14	114.33	105.25	109.71
	SD	10.47	13.82	12.18	17.93	15.09	15.48
PERFORMANCE IQ	$\bar{X}$	105.06	106.89	106.03	112.00	98.25	104.14
	SD	9.81	8.82	9.21	13.89	11.53	13.59
FULL SCALE IQ	$\bar{X}$	103.53	104.79	104.19	124.50	103.20	112.66
	SD	8.28	11.30	9.87	23.59	12.64	20.36

Table 2.2 - Project Design

			CONSECUTIVE WEEKS			
SAMPLE	AGE	N	OFF MEDS	BASELINE	EXP. DIET	CONTROL DIET
SPRING	6-12	4	1 2	3 4	5 6 7	8 9 10
		6	1 2	3 4	8 9 10	5 6 7
SUMMER	3-6	5	1 2	3 4	5 6 7	8 9 10
		5	1 2	3 4	8 9 10	5 6 7
FALL	6-12	13	1 2	3 4	5 6 7 8	9 10 11 12
		13	1 2	3 4	9 10 11 12	5 6 7 8

EXAMPLES OF FOODS NOT PERMITTED ON THE EXPERIMENTAL DIET

Breakfast cereals with artificial colors/flavors

Salicylate containing foods*, e.g., almonds, apples, apricots, oranges, tomatoes, cucumbers, strawberries

Bologna, ham, frozen fish

Flavored yogurt, ice cream+, instant breakfast drinks

Cake mixes, raisin bread, flavored gelatins, cakes

Any food item containing artificial food colors or flavors and/or salicylates

EXAMPLES OF ITEMS RESTRICTED FROM BOTH DIETS

All soft drinks (except 7-UP)

Aspirin compounds

Cough Drops

Toothpaste (baking soda substituted)

Medications (clearance required from project pediatrician)

*Analysis for salicylic acid and salicylate esters by thin layer chromatography with a 0.2 µg. sensitivity was negative for oranges, tangelos, grapefruit, strawberries, almonds and lemons. The tests were performed by Samy Ashoor and F. S. Chu at the Food Research Institute, University of Wisconsin-Madison.

+Our K-P diet permitted two flavors of ice cream specially prepared at the University of Wisconsin Dairy, free of artificial flavors and colors. Two flavors of ice cream from the same source but containing usual amounts of artificial flavors and colors were provided for the control diet.

H5

Table 2.4 Frequency and Mean of Weekly Individual Dietary Infractions for the School-Age Children During the Experimental Diet for Each Diet Order

DIET ORDER
Experimental-Control (N=17)

S#	WEEKS 1	2	3	4
2	1	3	0	-
3	10	4	0	-
6	4	3	0	-
11	0	1	3	-
22	0	0	0	0
27	0	1	0	1
28	1	0	0	0
29	2	0	3	2
30	0	2	0	0
32	1	0	1	1
35	2	0	1	1
36	5	1	2	3
40	2	1	0	0
41	0	1	1	0
43	0	0	0	0
44	0	0	0	0
45	0	1	0	0
SUM	28	18	11	8
$\bar{X}$	1.65	1.06	.65	.62

DIET ORDER
Control-Experimental (N=19)

S#	WEEKS 1	2	3	4
1	1	0	1	-
4	0	0	1	-
5	0	4	1	-
7	1	5	1	-
9	1	2	2	-
10	0	0	0	-
23	2	9	1	1
24	1	1	1	1
25	0	1	0	0
26	5	2	0	0
31	0	1	0	0
33	1	0	2	0
34	0	0	0	0
37	3	0	0	2
38	3	4	0	0
39	2	1	0	0
42	2	0	1	0
46	0	9	2	0
47	0	3	0	1
SUM	22	42	13	5
$\bar{X}$	1.16	2.21	.68	.39

Table 2.5 Frequency and Mean of Weekly Individual Dietary Infractions for the School-Age Children During the Control Diet for Each Diet Order

DIET ORDER
Experimental-Control (N=17)

S#	WEEKS 1	2	3	4
2	0	0	0	-
3	3	0	0	-
6	0	0	0	-
11	0	0	0	-
22	0	0	0	0
27	1	0	0	0
28	0	0	0	0
29	1	1	0	1
30	0	0	0	0
32	0	0	0	0
35	0	2	1	3
36	1	1	3	0
40	0	0	0	0
41	1	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	1	0
SUM	7	4	5	4
$\bar{X}$	.41	.23	.29	.31

DIET ORDER
Control-Experimental (N=19)

S#	WEEKS 1	2	3	4
1	0	0	0	-
4	1	0	0	-
5	3	1	0	-
7	1	3	0	-
9	0	2	1	-
10	3	0	2	-
23	0	0	1	1
24	3	2	0	0
25	0	0	0	0
26	0	2	2	0
31	0	1	1	0
33	2	1	0	0
34	3	1	0	0
37	2	0	0	0
38	1	0	1	0
39	2	0	0	1
42	1	0	0	0
46	0	0	0	1
47	0	2	1	2
SUM	22	15	9	5
$\bar{X}$	1.16	.79	.47	.38

Table 2.6 Summary of Dietary Infractions for the School-Age Children During the Experimental and Control Diets for Each Diet Order

		Diet Order EXP-CNT (N=17)		Diet Order CNT-EXP (N=19)	
		EXP	CNT	EXP	CNT
DIETARY INFRACTION					
$\bar{X}$/Week	$\bar{X}$	.995	.31	1.11	.70
	SD	.48	.07	.80	.35
$\bar{X}$/Diet Period	$\bar{X}$	1.10	.31	1.17	.76
	SD	1.22	.50	.92	.50

Table 2.7 Summary of Dietary Infractions for the Preschool Children During the Experimental and Control Diets for Each Diet Order

		Diet Order EXP-CNT (N=5)		Diet Order CNT-EXP (N=5)	
		EXP	CNT	EXP	CNT
DIETARY INFRACTIONS					
$\bar{X}$/Week	$\bar{X}$	1.47	.73	2.20	1.47
	SD	.64	.12	1.64	1.95
$\bar{X}$/Diet Period	$\bar{X}$	1.47	.73	2.20	1.47
	SD	1.57	.60	2.72	1.50

SECTION II: REFERENCES

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Conners, C. K. Symptom patterns in hyperkinetic neurotic and normal children. Child Development, 1970, 41, 667-682.

Conners, C. K., Goyette, C. H., Southwick, D. A., Lees, J. M., and Andrulonis, P. A. Food additives and hyperkinesis: a controlled double-blind experiment. Pediatrics, 1976, 58, 154-166.

Diagnostic and statistical manual of mental disorders, 2nd. Ed., Washington, D.C.: American Psychiatric Association, 1968, p. 50.

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APPENDIX II

AGE DISTRIBUTIONS OF EXPERIMENTAL AND CONTROL SCHOOL-AGE CHILDREN

GROUP	AGE (YR.)	FREQUENCY	%
EXPERIMENTAL			
DIET ORDER EXP-CNT	6	1	5.88
	7	1	5.88
	8	2	11.76
	9	5	29.42
	10	5	29.42
	11	1	5.88
	12	2	11.76
	$\bar{X} = 9$	$\Sigma = 17$	100.00
DIET ORDER CNT-EXP	6	3	15.79
	7	4	21.04
	8	3	15.79
	9	2	10.53
	10	2	10.53
	11	2	10.53
	12	3	15.79
	$\bar{X} = 9$	$\Sigma = 19$	100.00
COMBINED DIET ORDERS	6	4	11.11
	7	5	13.89
	8	5	13.89
	9	7	19.44
	10	7	19.44
	11	3	8.34
	12	5	13.89
	$\bar{X} = 9$	$\Sigma = 36$	100.00
CONTROL SUBJECTS	6	1	8.33
	7	1	8.33
	8	3	25.00
	9	2	16.68
	10	3	25.00
	11	1	8.33
	12	1	8.33
	$\bar{X} = 9$	$\Sigma = 12$	100.00

AGE DISTRIBUTIONS OF PRESCHOOL CHILDREN

GROUP	AGE (YR.)	FREQUENCY	%
DIET ORDER EXP-CNT	4	3	60.00
	5	2	40.00
	$\bar{X}$ = 4.5	Σ = 5	100.00
DIET ORDER CNT-EXP	3	1	20.00
	4	2	40.00
	5	2	40.00
	$\bar{X}$ = 4.0	Σ = 5	100.00
COMBINED EXPERIMENTAL	3	1	10.00
	4	5	50.00
	5	4	40.00
	$\bar{X}$ = 4.0	Σ = 10	100.00

EXPERIMENTAL DIET - SUGGESTED MENUS

Breakfast	Lunch	Dinner
Grapefruit Half Sara Lee Coffee Cake Boiled Egg Milk	Grilled Ham & Cheese Sandwich Soup Lemon Squares Milk	Roast Turkey Mashed Potatoes Creamed Corn *Cranberry Sauce Vanilla Ice Cream with Homemade Chocolate Sauce Milk
*Cranberry Juice Cereal Toast/Butter Milk	Turkey Sandwich with Lettuce/Mayonnaise Pringles Banana Lemon Squares Milk	Cheesy Denver Sandwich on Toasted Buns Cottage Cheese with Sliced *Pineapple Buttered Green Beans Dessert Milk
*Canned Figs Hot Cereal with Brown Sugar/Milk English Muffins Butter/Honey Milk	Tuna Sandwich *Carrot Sticks Sliced Pears Twinkie Milk	Pork Steaks Mashed Potatoes/Gravy *Buttered Spinach *Sweet Potatoe Cake Milk
Grapefruit Juice or *Cranberry Juice Scrambled Eggs Toast/Butter Cinnamon & Sugar Milk	Bologna & Cheese Sandwich with Lettuce/Mustard Pringles *Carrot Sticks Cake Milk	Turkey Casserole Rolls and Butter Pear Halves with *Cranberry Sauce in Middle Buttered Peas Dessert Milk

*Items to be included in this week's diet at least as often as indicated

CONTROL DIET - SUGGESTED MENUS

Breakfast	Lunch	Dinner
Orange Juice Cereal English Muffins Butter/Jelly Milk	Cheese Omelet Fresh Fruit Salad Date Muffins Milk	Spaghetti & Meatballs Buttered Garlic Bread Tossed Salad/Dressing Dessert Milk
*Pineapple Juice Boiled Egg Toast/Butter/ Jelly Milk	Bologna Sandwich with Cheese/Lettuce/ Mayonnaise *Carrot Sticks Fresh Fruit Candy Bar Milk	Dried Beef Casserole or on Toast Buttered Peas Crescent Rolls Chocolate Pudding Milk
Orange Juice *Presweetened Cereal Toast/Butter Milk	Dried Beef & Cheese Sandwich with Lettuce/Mayonnaise Fresh Fruit *Fig Newtons Milk	Meatloaf *Baked Sweet Potatoes Buttered Lima Beans *Date Bars Milk
*Cranapple Juice Oatmeal/Banana & Brown Sugar Toast/Butter Milk	Meatloaf Sandwich with Lettuce/Mayonnaise Corn Chips *Carrot Sticks *Date Bars Milk	Fried Chicken Mashed Potatoes/Gravy Buttered Beets Dessert Milk

*Items to be included in this week's diet at least as often as indicated

SECTION III - Demographic Information

Prior to the onset of dietary intervention, parents of the experimental and control children were interviewed utilizing assessment inventories developed by the Psychopharmacology Research Branch of the National Institute of Mental Health for use in their Early Clinical Drug Evaluation (ECDEU) program (Guy, 1976).

3.1 Children's Personal Data Inventory

The Children's Personal Data Inventory (CPDI) was completed for each S (Appendix III). Demographic information on the school-age, preschool age and school-age control groups is given in Table 3.0. The experimental and control Ss were predominately white and lived in suburban Madison. In the school and preschool age samples, more than half the Ss were first born, compared to approximately 42% of the nonhyperactive control group. Parental education level is relatively high for the school-age experimental sample with 33% of the mothers and 38% of the fathers reporting a college or professional education. Fifty percent of the mothers in the smaller group of preschool Ss were in this education category, as were 60% of the fathers. The mothers of the control group sample were predominately high school graduates (58.3%); fathers tended to have completed high school (38.3%) or some college/ technical training (33.3%).

The experimental school-age Ss were enrolled in grades ranging from kindergarten to seventh. Grade placement distribution was similar for the control group. Seventy-eight percent of the parents of the hyperactive Ss described their child as experiencing major problems in school, while the control children were judged by their parents as essentially

free of significant school-related difficulties. Table 3.1 shows the parents' age for each diet order group and the control sample.

Developmental history for the three groups (preschool, school-experimental, and school-control) is summarized in Table 3.2. Inspection of the group means and standard deviations does not reveal striking differences among the three groups in rate of acquisition of these development milestones. The accuracy of the data is of course entirely dependent upon the parents' ability to correctly recall their child's age for each of the developmental milestones. Although parents were instructed prior to the interview to bring along available baby records-books and a majority did so, the reliability of such information remains uncertain.

3.2 Children's Diagnostic Scale

The Children's Diagnostic Scale (CDS) of the ECDEU program was completed for all 46 experimental Ss. Descriptions of the CDS items and frequency and percentage of Ss rated on each of these items are given for the school and preschool groups in Appendix III.

3.3 Children's Symptom History

Parents' responses in an interview (J.P.H.) to the Children's Symptom History (CSH) for the school, preschool, and control groups are presented in Table 3.3. The low frequency of adverse parent ratings for the control group stands in striking contrast to the symptoms/behaviors ascribed by parents to the experimental school-age Ss. Using cluster analysis techniques, the CSH items have been categorized by ECDEU into seven major symptom areas, as shown in Table 3.4 and 3.5. The hyperactive school-age Ss (Table 3.4) were found to have significantly greater

severity of symptoms in all behavioral categories than the control group, except for the interpersonal relations cluster. Although the lack of a preschool control group does not permit comparable statistical tests, the mean cluster scores in Table 3.5 of the preschool experimental Ss are of approximately the same magnitude as those of the school-age Ss (Appendix III).

3.4 Prior Medication

Children receiving medication (e.g. Ritalin) for the treatment of their hyperactive symptoms were not excluded from participating in the study, but were taken off medications at least two weeks prior to the initiation of baseline. The total number (18) of children in the experimental school-age group on medication prior to the study were nearly equally divided between the two diet orders (Table 3.6). Therefore, the diet order groups were balanced for the number of children who were assumed to be candidates for, if not "responders" to stimulant medication. The dosage and type of medication the experimental Ss were receiving prior to baseline are given in Table 3.7.

Table 3.0 Children's Personal Data Inventory (CPDI)

	School-Age EXPERIMENTAL GROUP (N=36)		Preschool EXPERIMENTAL GROUP (N=10)		School-Age CONTROL GROUP (N=12)	
	Frequency	%	Frequency	%	Frequency	%
RACE						
Caucasian	32	88.88	10	100.00	12	100.00
Black	2	5.56	0	-	0	-
Other	2	5.56	0	-	0	-
RESIDENCY						
Urban	1	2.78	0	-	0	-
Suburban	35	97.22	10	100.00	11	91.67
Rural	0	-	0	-	1	8.33
SIBLING ORDER						
1 of 1	4	11.11	1	10.00	0	-
1 of 2	12	33.33	3	30.00	3	25.00
1 of 3	3	8.33	1	10.00	2	16.67
1 of 4	1	2.78	0	-	0	-
2 of 2	4	11.11	5	50.00	0	-
2 of 3	7	19.45	0	-	0	-
2 of 4	0	-	0	-	1	8.33
3 of 3	3	8.33	0	-	0	-
3 of 4	0	-	0	-	1	8.33
4 of 4	1	2.78	0	-	2	16.67
4 of 8	0	-	0	-	1	8.33
5 of 5	1	2.78	0	-	1	8.33
6 of 8	0	-	0	-	1	8.33
FAMILY CONSTELLATION						
Natural Mother, Father & Sibs	20	55.55	6	60.00	8	66.67
Adoptive Parent/s & Sibs	5	13.89	1	10.00	1	8.33
Natural Mother, Step-father, & Sibs	3	8.33	0	-	1	8.33
Natural Mother	3	8.33	1	10.00	0	-
Natural Mother & Sibs	2	5.56	2	20.00	1	8.33
Natural Mother & Father	2	5.56	0	-	1	8.33
Natural Mother, Relatives & Sibs	1	2.78	0	-	0	-

Table 3.0 Children's Personal Data Inventory (CPDI) (Cont'd.)

	School-Age EXPERIMENTAL GROUP (N=36)		Preschool EXPERIMENTAL GROUP (N=10)		School-Age CONTROL GROUP (N=12)	
	Frequency	%	Frequency	%	Frequency	%
MOTHER'S EDUCATION						
Graduate/Professional	4	11.11	2	20.00	1	8.33
College Graduate	8	22.22	3	30.00	0	-
Some College/Technical	14	38.89	5	50.00	4	33.33
High School Graduate	9	25.00	0	-	7	58.33
Some High School	1	2.77	0	-	0	-
FATHER'S EDUCATION						
Graduate/Professional	8	22.22	3	30.00	2	16.67
College Graduate	6	16.67	3	30.00	0	-
Some College/Technical	8	22.22	1	10.00	4	33.33
High School Graduate	7	19.44	0	-	4	33.33
Some High School	0	-	0	-	1	8.33
Not Applicable	7	19.44	3	30.00	1	8.33
GRADE IN SCHOOL						
Not in School	0	-	10	100.00	0	-
Kindergarten	1	2.78	0	-	0	-
First	4	11.11	0	-	1	8.33
Second	6	16.67	0	-	3	25.00
Third	5	13.89	0	-	2	16.67
Fourth	7	19.44	0	-	2	16.67
Fifth	7	19.44	0	-	2	16.67
Sixth	2	5.56	0	-	1	8.33
Seventh	4	11.11	0	-	1	8.33
SCHOOL HISTORY						
No Significant Problems	0	-	0	-	10	83.33
Minor Problems	8	22.22	0	-	2	16.67
Major Problems/Current Year	3	8.33	0	-	0	-
History of Major Problems	19	52.78	0	-	0	-
Continual Major Problems	6	16.67	0	-	0	-

Table 3.1 Parents' Mean Age of School-Age and Preschool Experimental and School-Age Control Groups

	School-Age Children Diet Order			Control	Preschool Children Diet Order		
	EXP-CNT (N=19)	CNT-EXP (N=17)	TOTAL (N=36)	(N=12)	EXP-CNT (N=5)	CNT-EXP (N=5)	TOTAL (N=10)
MOTHER'S AGE (Yrs.)	35.76 5.71	32.72 3.48	34.20 4.87	35.25 6.74	34.50 4.15	28.00 1.87	31.10 4.46
FATHER'S AGE (Yrs.)	39.69 7.34	36.00 4.51	37.77 6.21	35.27 5.12	36.20 5.45	28.00 1.41	33.86 6.01

Table 3.2 Developmental History (Months)

	EATING SOLID FOODS		FED SELF WITH SPOON		SAT UNSUPPORTED		WALKING		FIRST WORDS		FIRST SENTENCES		TRAINED BLADDER		TRAINED BOWELS	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
PRESCHOOL (3 to 5-11)	9.2	2.1	16.1	7.3	7.7	2.0	12.4	2.8	12.9	4.5	21.6	6.5	27.7	5.1	27.6	7.0
SCHOOL-AGE (6-0 to 12-11)	8.7	3.3	12.7	4.5	6.5	1.4	11.7	2.6	15.2	5.5	21.2	5.9	26.8	6.9	28.4	6.9
SCHOOL-AGE CONTROLS (6-0 to 12-11)	8.1	1.9	12.3	3.2	7.2	1.4	11.6	1.4	10.9	2.1	19.8	4.2	24.8	5.7	25.4	5.9
NORMATIVE VALUES	8-12		12-23		5-7		11-13		12-20		24-42		18-28		15-24	

Table 3.3 Children's Symptom History (CSH)

SYMPTOM/BEHAVIOR	GROUP		
	PRESCHOOL 3-0 to 5-11 (N=10)	EXPERIMENTAL 6-0 to 12-11 (N=36)	CONTROL 6-0 to 12-11 (N=12)
SEVERE HEADACHES	2	8	0
STOMACHACHES	6	15	0
NAUSEATED	0	7	0
WETS BED	3	9	0
WETS PANTS	3	6	0
SOILS HIMSELF	1	3	0
TEMPER TANTRUMS	10	30	3
CRIED WHEN GOING TO SCHOOL	5	11	0
REFUSED TO GO TO SCHOOL	4	9	0
TRUANTED FROM SCHOOL	2	2	0
GETS ALONG WITH SIBLINGS	6	16	11
GETS ALONG WITH YOU	9	28	12
GETS ALONG WITH SPOUSE	9	29	12
AFFECTIONATE	10	29	12
STUTTERS	2	3	0
DIFFICULTY WITH SPEECH	3	11	0
TAKES THINGS	5	21	0
DIFFICULTY WITH EATING	2	9	0
DIFFICULTY WITH SLEEPING	7	13	0
FIDGETY	10	35	0
DESTRUCTIVE	4	14	0
GETS INTO THINGS	7	31	3
GETS INTO FIGHTS	6	26	0
GETS ALONG POORLY WITH KIDS	5	22	0
HAS FRIENDS	10	21	12
SEES THEM OUTSIDE SCHOOL	10	24	11
GETS BULLIED	4	30	2
PICKS ON OTHERS	6	24	0
GOOD MIXER	8	14	11
DOES THINGS ON OWN	8	30	11
WORRIES	3	25	6
IRRITABLE	9	32	1
UNHAPPY	2	9	0
MANNERISMS	1	5	0
SUCKS THUMB	2	3	1
SUCKS ANYTHING ELSE	0	4	0
BITES NAILS	2	11	3
BITES PENCILS	1	13	0
DISOBEDIENT	10	26	0
POOR CONCENTRATION	7	34	3
AFRAID OF ANYTHING	6	16	1
OVERY FUSSY	4	13	0
TELLS LIES	7	25	2
UNUSUAL AMOUNT OF ACTIVITY	4	29	1
OVERACTIVE	9	36	0

Table 3.4 Children's Symptom History (CSH) for School-Age Experimental and Control Groups

	DIET ORDER				EXPERIMENTAL GROUP		CONTROL GROUP	
	EXP-CNT (N=17)		CNT-EXP (N=19)		(N=36)		(N=12)	
CLUSTER CATEGORY	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Somatic Problems	.19	.11	.15	.14	.17	.13	.03*	.00
Hostile/Antisocial	.55	.19	.50	.19	.52	.19	.01*	.05
School Problems	.15	.23	.16	.19	.16	.21	.00*	.00
Interpersonal Relations	.66	.14	.62	.16	.64	.15	.65	.07
Fear & Worry	.63	.24	.55	.20	.59	.22	.21*	.21
Habits/Mannerisms	.24	.21	.19	.13	.21	.17	.04*	.06
Hyperactivity	.82	.24	.74	.25	.78	.25	.05*	.17
Total	32.94	8.18	28.47	6.63	30.58	7.60	10.75*	2.80

*p <.05 Experimental vs Control Groups

NOTE: CSH total score reflects degree of pathology/severity, i.e., the higher the score the greater the number of symptoms rated present in the child's history.

Table 3.5 Children's Symptom History (CSH) for Experimental Preschool Group

	DIET ORDER					
	EXP-CNT (N=5)		CNT-EXP (N=5)		COMBINED (N=10)	
CLUSTER CATEGORY	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Somatic Problems	.19	.11	.26	.10	.22	.11
Hostile/Antisocial	.55	.10	.59	.24	.57	.18
School Problems	.25	.29	.38	.39	.32	.34
Interpersonal Relations	.71	.13	.76	.16	.73	.14
Fears & Worry	.35	.14	.55	.41	.45	.31
Habits/Mannerisms	.10	.06	.23	.14	.16	.12
Hyperactivity	.36	.09	.76	.26	.56	.28
Total	29.80	4.27	37.60	10.11	33.70	8.39

NOTE: CSH total score reflects degree of pathology/severity, i.e., the higher the score the greater the number of symptoms rated present in the child's history.

DURATION	DIET ORDER (EXP-CNT (N=17) Frequency	%	(CNT-EXP (N=19) Frequency	%	COMBINED (N = 36) Frequency	%
NO MEDICATION	8	47.00	10	52.60	18	50.00
2 MONTHS	1	5.80	-	-	1	2.78
8 MONTHS	-	-	1	0.52	1	2.78
12 MONTHS	2	11.76	-	-	2	5.56
18 MONTHS	1	5.80	2	10.50	3	8.39
24 MONTHS	1	5.80	1	0.52	2	5.56
36 MONTHS	2	11.76	2	10.50	4	11.19
42 MONTHS	1	5.80	-	-	1	2.78
48 MONTHS	-	-	1	0.52	1	2.78
50 MONTHS	1	5.80	-	-	1	2.78
72 MONTHS	-	-	1	0.52	1	2.78
84 MONTHS	-	-	1	0.52	1	2.78

Table 3.7 Medication History Immediately Prior to Project Participation

SCHOOL-AGE GROUP

Subject Number	Medication	Dosage (mg/day)
4	Ritalin	20
7	Ritalin	10
9	Ritalin	10
11	Ritalin	10
23	Ritalin	20
26	Ritalin	15
28	Ritalin	20
29	Ritalin	5
30	Ritalin	10
31	Ritalin	10
36	Cylert	18.75
38	Dexadrine	20
40	Ritalin	30
41	Ritalin	30
42	Ritalin	30
44	Ritalin	25
45	Ritalin	10
46	Ritalin	20

PRESCHOOL GROUP

12	Ritalin	20

SECTION III: REFERENCES

Guy, W. ECDEU Assessment Manual for Psychopharmacology, DHEW Publication No. 76-338, 1976.

APPENDIX III

~~IH-B-62~~
-73

CHILDREN'S PERSONAL DATA INVENTORY

C P D I

INSTRUCTIONS: *Insert General Scoring Sheet and Code 10 for Sheet Number. Code 000 for PERIOD.*

Raters are cautioned to be particularly careful in coding their responses since several items have sub parts which must be coded on the same row. Follow the coding instructions carefully. Complete once for each subject. Please answer all items.

If information is not ascertained, mark a field of "9"s, e.g., 9, 99, 999 etc.

Mark on right half of scoring sheet on row specified	ROW NO.
1. IDENTIFICATION (Note: *Sex of subject is coded within Patient Number*)	
a. **Subject's Age:** Mark time units – 1 = months; 2 = years on Rc. / 1 and give numeric (2 digits) on Rows 2 - 3	1 2-3
b. **Subject's Race is:** *Code both b and c on Row 4* 0 = Caucasoid 1 = Negroid 2 = Mongoloid 3 = Other	4
c. **Has Subject's Residence Been:** 5 = Primarily urban 6 = Primarily suburban 7 = Primarily rural	
d. **Sibling Sequence:** Subject is the *enter number (2 digits)* child . . of *enter number (2 digits)* children . . . . (Only child is coded "the 01 child of 01 children")	5-6 7-8
e. **Is Subject One of Twins, Triplets, etc.?** 0 = No; 1 = Yes, homozygous; 2 = Yes, heterozygous; 3 = Yes, unknown zygosity	9
f. **The Subject's Present Family Constellation Consists of:** *(Mark all applicable on Row 10)* 0 = Natural mother 1 = Natural father 2 = Step-parent 3 = Adoptive parent/s 4 = Paid foster parents 5 = Adult relative/s (grandparents, uncles, aunts, etc.) 6 = Siblings, step-siblings and/or other children 7 = Subject not living with family; is in non-psychiatric institution 8 = Subject not living with family; is in psychiatric institution/unit	10
2. PARENTS' DEMOGRAPHY **Is either NATURAL parent:** *Code both a and b on Row 11*	11
a. **Dead?** 0 = No; 1 = Yes, mother; 2 = Yes, father; 3 = Yes, both	
b. **Divorced or out of home?** 5 = No; 6 = Yes, mother; 7 = Yes, father; 8 = Yes, both	
c. **Mother's Age:** Mother or mother surrogate presently in the home *(2 digits)* 00 = Not applicable	12-13
d. **Father's Age:** Father or father surrogate presently in the home *(2 digits)* 00 = Not applicable	14-15

Continue marking on right half of scoring sheet on row specified	ROW NO.
PARENTS' EDUCATION	
e. **Mother or Present Surrogate** *Code highest level attained for MOTHER*	16
f. **Father or Present Surrogate** *Code highest level attained for FATHER*	17
0 = Not applicable; 1 = Graduate professional training; 2 = College graduate; 3 = Some college or technical school; 4 = High school graduate; 5 = Some high school (10-11); 6 = Junior high school (7, 8, 9); 7 = Less than 7 years of school; 9 = Not ascertained	
PARENTS' OCCUPATION	
g. **Mother's or Female Surrogate's Present Occupational Status is:** . . .	18
h. **Father or Male Surrogate's Present Occupational Status is:**	19
Use this code for g and h: 0 = Not applicable; 1 = Full time gainful employment; 2 = Part time gainful employment; 3 = Unemployed; 4 = Dependent spouse or student; 5 = Recipient of public or private assistance	
i. **Mother's or Female Surrogate's Highest Occupational Attainment is:** .	20
j. **Fathers or Male Surrogate's Highest Occupational Attainment is:** . .	21
Use this code for i and j. *See Manual for detailed list of occupations.* 1 = Higher executive, proprietor of large concern, major professional 2 = Business manager of large concern, proprietor of medium-sized business, lesser professional 3 = Administrative personnel, owner of small independent business, minor professional 4 = Clerical or sales worker, technician, owner of little business 5 = Skilled manual employee 6 = Machine operator, semi-skilled employee 7 = Unskilled employee 8 = Never worked in paid employment 9 = Not ascertained	
Has either parent or present surrogate been: *Mark one response for each item using this code:* 0 = Neither parent; 1 = Mother; 2 = Father; 3 = Both parents	
k. Out of home *(3 months or longer)* due to physical or mental illness . .	22
l. Separated *(3 months or longer)* due to marital difficulties	23
m. Cruel or abusive *(to patient, spouse, siblings, etc.)*	24
n. Not a steady worker or competent housewife	25

CHILDREN'S PERSONAL DATA INVENTORY

Continue marking on right half of scoring sheet on row specified

3. FAMILY HISTORY OF PSYCHIATRIC ILLNESS

Has there been a history of psychiatric illness in family member/s?

Mark all applicable for each item using this code:

0 = None of the members
1 = Natural mother
2 = Natural father
3 = Siblings
5 = Present mother surrogate
6 = Present father surrogate

		Row No.
a.	Non-psychotic psychiatric disturbance	26
b.	Manic-depressive disturbance	27
c.	Other major affective disturbance	28
d.	Schizophrenia	29
e.	Other psychotic disturbance	30
f.	Hospitalized for any psychiatric illness	31
g.	Mental deficiency	32
h.	Excessive use of alcohol	33
i.	Excessive use of drugs	34
j.	Imprisonment	35

4. SUBJECT'S HISTORY OF PSYCHIATRIC ILLNESS

Treatment Status *Code both a and b on Row 36* — Row No. 36

a. Subject is presently: *(Mark one)*
1 = Not in any type of psychiatric treatment
2 = In psychiatric treatment as an outpatient
3 = In partial hospitalization, e.g., day or night hospital, halfway house, etc.
4 = Hospitalized (24 hour)

b. Prior to this episode, subject has: *(Mark all applicable)*
5 = Never had any type of psychiatric treatment
6 = Received psychiatric outpatient treatment
7 = Received treatment in partial hospitalization setting
8 = Received treatment in 24-hour hospital

"Psychiatric treatment" should be interpreted broadly to include all forms of therapy whose basic function is the alleviation of emotional, behavioral or mental disturbance. "Partial hospitalization" and 24-hour hospitalization include all forms of treatment environments in which the subject spends a substantial part of the day or, in the latter case, the full day.

c. Age *(years)* when first received treatment for psychiatric illness *(2 digits)* — Row No. 37-38
00 = Never treated

d. Estimate total duration of ALL outpatient psychiatric treatment — exclusive of present episode — Row No. 39-41
Give time units *(0 = days; 1 = weeks; 2 = months; 3 = years)* and duration *(2 digits)*
EXAMPLE: Subject's total treatment amounts to 10 months.
Code 210. 000 = No outpatient treatment

Mark on left half of scoring sheet on row specified

4. SUBJECT'S HISTORY OF PSYCHIATRIC ILLNESS — Continued

Row No. 1-3

e. Estimate total duration of ALL partial hospitalization — exclusive of present episode
Give time units *(0 = days; 1 = weeks; 2 = months; 3 = years)* and duration *(2 digits)* 000 = No partial hospitalization

Row No. 4-6

f. Estimate total duration of ALL hospitalizations *(24 hour)* exclusive of present episode
Give time units *(0 = days; 1 = weeks; 2 = months; 3 = years)* and duration *(2 digits)*
EXAMPLE: Subject's total hospitalization amounts to 4 years
Code 304 000 = No hospitalizations

Row No. 7-9

g. Duration of present episode
Mark whether coded in 0 = days 1 = weeks 2 = months 3 = years and give duration *(2 digits)* 000 = Not applicable

5. SUBJECT'S DEVELOPMENTAL HISTORY

Code a, b and c on Row 10

Row No. 10

a. Pregnancy and Neonatal Course Were:
0 = Normal
1 = Suspected abnormalities
2 = Definite abnormalities
3 = Not ascertained

b. Were there infant feeding problems?
4 = YES
5 = NO
6 = Not ascertained

c. Colic?
7 = YES
8 = NO
9 = Not ascertained

For each of the following items d through k, record months in 2 digits and judge rate of development on next row:

Row No.		
11-12	d.	Age *(months)* first ate solids - not pureed or strained food
13		Considered 0 = Slow; 1 = Normal 2 = Fast
14-15	e.	Age *(months)* first fed self with a spoon
16		Considered 0 = Slow; 1 = Normal; 2 = Fast
17-18	f.	Age *(months)* sat unsupported
19		Considered 0 = Slow; 1 = Normal; 2 = Fast
20-21	g.	Age *(months)* first walked by self without holding on
22		Considered 0 = Slow; 1 = Normal; 2 = Fast
23-24	h.	Age *(months)* first words other than Mama and Dadda
25		Considered 0 = Slow; 1 = Normal; 2 = Fast

CHILDREN'S DIAGNOSTIC SCALE (CDS)

CDS ITEM

1. Psychoticism--Gross impairment of relationship with people and environment; bizarre interaction; extreme preoccupation with internal stimuli; responses appear markedly inappropriate to external stimuli and/or displays irrelevant or tangential content; or confused about reality or morbid or bizarre ideation, delusions, hallucinations; or permeated by loosening of associations, illogical or contradictory statements.

2. Anxiety Reaction--Expresses feelings of nervousness anxiety, unrealistic fears or worries; concern with feelings of inadequacy; inferiority, shyness, obsessions or compulsions.

3. Withdrawal Reaction--Isolation seclusiveness, withdrawal, detachment, inability to form close relationships.

4. Unsocialized Aggressive Behavior--Overtly negative, defiant, hostile, and/or manipulative, evasive, guarded. Attempts to control others; aggressive, antisocial; overwhelming selfish. Denial of anxiety and personal responsibility for feelings and acts. Is in hostile conflict with the environments in a variety of social settings (family, school) which do not involve group expression of hostility.

5. Socialized Aggressive Behavior--Is in delinquent or hostile conflict with the environment, primarily in association with members of a gang, rarely on own.

6. Explosive Aggression--Unable to control appropriately his response towards peers and/or adults. Physically aggressive, impulsive, often reacts to others before understanding the meaning or motives of their words or actions. Gets into numerous fights. Physically disruptive particularly in classroom where he may hit out at others with little or no provocation.

7. Chronic Hyperactivity--High and conspicuous level of gross motor activity in a variety of settings such as school, home, stores, office, etc.

8. Immature and Inadequate Behavior--Variable and poorly organized personality characteristics and coping techniques.

9. Presence of Gross Organic Impairment--Do not include impression of minimal brain damage, but use all available examinational data such as neurological tests, EEG, etc. Gross organic impairment refers to findings which lead to a strong inference of anatomical lesions or organic diagnosis, e.g., hemiparesis, cerebral palsy, epilepsy, etc.

10. Delirium--Gross acute impairment of orientation (time, place or person) and/or memory, with clouding of sensorium. Unlike item 9, delirium should imply reversable organic impairment.

11. Presence of Gross Mental Retardation--Obvious to the examiner and/or found on psychometic tests.

NOTE: Subjects were evaluated once at pretreatment on a 7-point rating scale (not present to extremely severe) using all available data sources, e.g., parent's and school reports, interview, etc.

CHILDREN'S DIAGNOSTIC SCALE CLASSIFICATION (CDS)
FOR SCHOOL-AGE CHILDREN (N=36)

CDS ITEM

	FREQUENCY	%
1. PSYCHOTISM		
Not Present	36	100.0
2. ANXIETY REACTION		
Not Present	12	33.0
Very Mild	4	11.0
Mild	8	22.0
Moderate	12	33.0
3. WITHDRAWAL REACTION		
Not Present	15	41.7
Very Mild	5	13.9
Mild	6	16.7
Moderate	7	19.4
Moderately Severe	2	5.5
Severe	1	2.7
4. UNSOCIALIZED AGGRESSIVE BEHAVIOR		
Not Present	14	38.9
Very Mild	2	5.5
Mild	8	22.2
Moderate	8	22.2
Moderately Severe	2	5.5
Severe	2	5.5
5. SOCIALIZED AGGRESSION		
Not Present	36	100.0
6. EXPLOSIVE AGGRESSION		
Not Present	14	38.9
Very Mild	9	25.0
Mild	5	13.9
Moderate	6	16.7
Moderately Severe	2	5.5
7. CHRONIC HYPERACTIVITY		
Mild	3	8.3
Moderate	17	47.2
Moderately Severe	8	22.2
Severe	7	19.4
Extremely Severe	1	2.7
8. IMMATURE AND INADEQUATE BEHAVIOR		
Not Assessed	36	100.0
9. PRESENCE OF GROSS ORGANIC IMPAIRMENT		
Not Present	36	100.0
10. DELIRIUM		
Not Present	36	100.0
11. PRESENCE OF GROSS MENTAL RETARDATION		
Not Present	36	100.0

CHILDREN'S DIAGNOSTIC SCALE AND CLASSIFICATION (CDS)
FOR PRESCHOOL CHILDREN (N=10)

CDS ITEM

	FREQUENCY	%
1. PSYCHOTICISM		
Not Present	10	100.0
2. ANXIETY REACTION		
Not Present	7	70.0
Very Mild	2	20.0
Moderate	1	10.0
3. WITHDRAWAL REACTION		
Not Present	10	100.0
4. UNSOCIALIZED AGGRESSION		
Not Present	2	20.0
Very Mild	1	10.0
Mild	3	30.0
Moderate	4	40.0
5. SOCIALIZED AGGRESSIVE BEHAVIOR		
Not Present	10	100.0
6. EXPLOSIVE AGGRESSION		
Not Present	2	20.0
Very Mild	2	20.0
Mild	3	30.0
Moderate	2	20.0
Moderately Severe	1	10.0
7. CHRONIC HYPERACTIVITY		
Mild	1	10.0
Moderate	3	30.0
Moderately Severe	6	60.0
8. IMMATURE AND INADEQUATE BEHAVIOR		
Not Ascertained	10	100.0
9. PRESENCE OF GROSS ORGANIC IMPAIRMENT		
Not Present	10	100.0
10. DELIRIUM		
Not Present	10	100.0
11. PRESENCE OF GROSS MENTAL RETARDATION		
Not Present	10	100.0

CHILDREN'S SYMPTOM HISTORY CLUSTER LISTING

CLUSTER NAME	ITEM #	ITEM CONTENT
SOMATIC PROBLEMS	1	DOES HE EVER HAVE SEVERE HEADACHES?
	1A	IS HE SICK WITH THEM?
	1B	DOES IT AFFECT HIS SIGHT AT ALL?
	2	DOES HE EVER HAVE STOMACHACHES?
	2A	DOES HE VOMIT WHEN HE HAS STOMACHACHES?
	3	IS HE EVER SICK AT HIS STOMACH (NAUSEATED)?
	3A	DOES HE VOMIT WHEN HE IS NAUSEATED?
	4	DOES HE EVER WET HIS BED?
	4A	HOW OFTEN DOES HE WET THE BED?
	5	DOES HE EVERY WET HIS PANTS?
	5A	DOES HE WET HIS PANTS REGULARLY?
	5B	HAS HE ALWAYS WET HIS PANTS?
	5C	DID HE START BEFORE HE WAS 5 YEARS OLD?
	6	DOES HE EVER SOIL HIMSELF?
	6A	DOES HE SOIL HIMSELF REGULARLY?
	6B	HAS HE ALWAYS SOILED HIMSELF REGULARLY?
	6C	DID HE START BEFORE HE WAS 5 YEARS OLD?
	6D	WHAT IS THE LONGEST PERIOD HE HAS BEEN CLEAN?
	15	DOES HE STUTTER OR STAMMER?
	16	HAS HE ANY OTHER DIFFICULTY WITH SPEECH?
	18	IS THERE ANY DIFFICULTY NOW WITH EATING?
	19	IS THERE ANY DIFFICULTY NOW WITH SLEEPING?
	19A	DOES HE HAVE ANY DIFFICULTY GETTING OFF TO SLEEP?
	19B	DOES HE EVER WAKE IN THE NIGHT?
	19C	DOES HE SCREAM?
	19D	DOES HE COME TO YOUR BED?
	19E	DOES HE EVERY HAVE NIGHTMARES OR WAKE UP WITH BAD DREAMS?
	19F	DOES HE EVER WALK IN HIS SLEEP?
	19G	DOES HE WAKE EARLY? (MORE THAN NORMAL FOR AGE)
HOSTILE/ANTISOCIAL BEHAVIOR	7	DOES HE EVERY HAVE TEMPER TANTRUMS
	7A	WHAT ARE THEY LIKE?
	7B	DOES HE LIE ON THE FLOOR?
	7C	DOES HE BREAK THINGS?
	7D	HOW OFTEN?
	7E	DO THEY LAST A LONG TIME?
	17	HAS HE EVER TAKEN THINGS THAT DON'T BELONG TO HIM?
	21	IS HE A DESTRUCTIVE CHILD?
	21A	DOES HE BREAK UP HIS OWN THINGS?
	21B	WHAT ABOUT OTHER PEOPLE'S THINGS?
	21C	DOES HE BREAK THINGS FREQUENTLY?
	22	DOES HE GET INTO THINGS THAT DON'T CONCERN HIM?
	23	DOES HE TEND TO GET INTO A LOT OF FIGHTS?
	32	DOES HE GET IRRITABLE OR CROSS EASILY?
	39	IS HE DISOBEDIENT A LOT?
	39A	IS HE DISOBEDIENT WITH OTHER PEOPLE?
	41	DOES HE TELL LIES?
SCHOOL PROBLEMS	8	HAS HE IN THE LAST YEAR EVERY CRIED/BEEN TEARFUL WHEN GOING TO SCHOOL?
	9	HAS HE EVER REFUSED TO GO TO SCHOOL
	10	HAS HE EVERY TRUANTED FROM SCHOOL
	10A	HOW OFTEN?

CLUSTER NAME	ITEM #	ITEM CONTENT
INTERPERSONAL RELATIONS	11	DOES HE GET ALONG WITH HIS BROTHERS/SISTERS?
	11A	HOW MUCH DO THEY FIGHT AND SQUABBLE?
	12	DOES HE GET ALONG WITH YOU?
	13	DOES HE GET ALONG WITH YOUR HUSBAND/WIFE?
	14	IS HE AN AFFECTIONATE CHILD?
	24	DOES HE GET ALONG POORLY WITH OTHER CHILDREN?
	25	HAS HE GOT ANY PARTICULAR FRIENDS?
	26	DOES HE SEEN THEM FREQUENTLY OUTSIDE SCHOOL?
	27	DOES HE GET BULLIED OR PICKED ON AT ALL?
	28	DOES HE TEND TO PICK ON OR BULLY OTHER CHILDREN?
	29	IS HE A GOOD MIXER?
	30	DOES HE TEND TO DO THINGS ON HIS OWN?
FEAR AND WORRY	31	DOES HE WORRY A LOT ABOUT THINGS?
	33	IS HE GENERALLY UNHAPPY OR MISERABLE?
	40	IS HIS CONCENTRATION POOR?
	41	HAS HE GOT ANYTHING HE'S AFRAID OF--LIKE DOGS OR CATS?
HABITS AND MANNERISMS	34	DOES HE HAVE ANY MANNERISMS OR TICS SUCH AS TWITCHES OF FACE?
	35	DOES HE SUCK HIS THUMB?
	36	DOES HE SUCK ANYTHING ELSE?
	37	DOES HE BITE HIS NAILS?
	38	DOES HE BITE PENCILS OR ANYTHING ELSE?
	42	DOES HE TEND TO BE OVER-FUSSY ABOUT THINGS?
	42A	ARE THERE THINGS HE INSISTS ON DOING ONLY IN A SPECIAL WAY?
	42B	HAS HE GOT ANY SILLY HABITS OR RITUALS?
HYPERACTIVITY	26	IS HE A FIDGETY CHILD?
	44A	WEARS OUT CRIB, TOYS, FASTER THAN OTHER CHILDREN?
	44B	WEARS OUT BIKE, TOYS, FASTER THAN OTHER CHILDREN?
	44C	WEARS OUT SHOES, CLOTHING, FASTER THAN OTHER CHILDREN?
	45	WOULD YOU SAY HE IS VERY OVERACTIVE OR RESTLESS?
ITEMS NOT INCLUDED IN CLUSTERS	2B	WHAT TIME OF DAY IS HE NAUSEATED?
	2C	ARE STOMACHACHES MORE ON WEEKENDS THAN DURING THE WEEK?
	2D	DOES HE GET STOMACHACHES DURING SCHOOL HOLIDAYS?
	3B	WHAT TIME OF DAY IS HE NAUSEATED?
	3C	IS HE NAUSEATED MORE ON WEEKENDS?
	4B	HAS HE ALWAYS WET HIS PANTS?
	4C	WHEN DID HE START?
	4D	WHAT IS THE LONGEST PERIOD HE HAS BEEN DRY?
	4E	DOES HE WET WHEN AWAY FROM HOME?
	5D	WHAT IS THE LONGEST PERIOD HE HAS BEEN DRY?
	5E	DOES HE WET WHEN AWAY FROM HOME?
	6E	DOES HE SOIL HIMSELF WHEN AWAY FROM HOME?
	7F	WHAT SEEMS TO BRING THEM ON?
	7G	DOES HE HAVE TANTRUMS WHEN AT SCHOOL?
	7H	DOES HE HAVE TANTRUMS WHEN WITH RELATIVES OR FRIENDS?
	7I	HOW DO YOU DEAL WITH THEM?
	10B	DOES HE GO HOME WHEN HE SHOULD HAVE BEEN IN SCHOOL?
	10C	DID OTHER CHILDREN TRUANT WITH HIM?
	17A	DOES HE TAKE THINGS FREQUENTLY?
	17B	DID HE TAKE THINGS FROM HOME?
	17C	DID HE TAKE THINGS FROM SCHOOL?

CLUSTER NAME	ITEM #	ITEM CONTENT
ITEMS NOT INCLUDED IN CLUSTERS (CON'T)	17D	DID HE TAKE THINGS FROM SHOPS?
	17E	WAS HE WITH OTHERS WHEN HE TOOK THINGS?
	17F	ANY CONTACT WITH POLICE?
	23	ARE THEY "FRIENDLY" FIGHTS?
	23B	ARE THEY "REAL FIGHTS?

SECTION IV - Physical-Neurological Examination

4.1 Procedure

Each child and his family were interviewed by a pediatric neurologist (L.G.T.) who obtained an extensive retrospective history of any events that might possible be associated with neurological dysfunction. A physical examination emphasizing the identification of minor congenital anomalies and opthalmological and auditory dysfunction was also performed. The neurological evaluation consisted of a structured examination directed at demonstrating focal neurological signs as well as the evaluation of "soft" signs (Appendix IV). The neurological "soft" signs were quantified by completing rating scales, Physical and Neurological Examination for Soft Signs--PANESS, developed by the Psychopharmacological Research Branch of the National Institutes of Mental Health. Children with a neurological history of high risk factors or an examination demonstrating "soft" neurological signs were classified as minimal brain dysfunction. Those individuals whose neurological examination or electroencephalogram (EEG) demonstrated evidence of focal abnormalities were designated as minimal brain damaged. The results of the psychometric testing, psychophysiological parameters and hyperactivity ratings were deliberately not made available to the pediatric neurologist at time of examination.

4.2 Physical Evaluation

The experimental group of 46 hyperactive males was divided into preschool age (N=10) and school-age (N=36) subgroups. The general physical growth parameters in these children (N=36) fell in a normal distribution with only 3 Ss with heights above the 97th percentile and

no child's height below the 10th percentile. Body weights of 33 of the sample were also within average range percentiles, with 3 Ss above the 97th percentile. Occipital-frontal head circumferences were also within two standard deviations for each S. The physical sizes of these children (with the exception of those who were adopted) were characteristic of the height and weight distributions of siblings. Vital signs including heart rate, blood pressure and respiration, and the results of a general medical examination were normal for all Ss. Two children had a history of allergies to common danders and grasses. One had been treated with medications for asthma in the past and the second had been hospitalized twice for bronchiolitis; neither S was on chronic medications at the time of the study. Other than these two Ss, the experimental Ss did not have a history of either chronic medical illnesses or allergies.

Examination for minor physical anomalies as outlined by Rapoport and Quinn (1975) and Quinn and Rapoport (1974) demonstrated the following frequency of occurrence: bilateral epicanthal folds (1), hypertelorism (1), moderately high arch palate (2), and slightly incurved 5th fingers bilaterally (1). No child had more than one of these physical anomalies. The only prevalent minor physical anomaly found was that 8 of the children had a head circumference greater than 1.5 standard deviations above the mean; however in all 8 instances, other growth parameters also were noted to be above the mean for their respective ages.

Electroencephalograms (EEGs) were performed on all Ss using the Grass 16-channel instrument. Reference and bipolar electrodes were placed using the 10-20 International System. Hyperventilation and photic stimulation were routinely performed. Sleep deprivation techniques were incorporated to promote spontaneous drowsiness. No sedation medication

was utilized to induce sleep. Table 4.0 describes the EEG abnormalities for the school-age group and the preschool group.

Results of standard clinical hematological studies and a urine analysis were all within normal limits for the 34 Ss in the experimental group (Table 4.1). Two S's information was unavailable due to technical errors. The mean erythrocyte lead level of 26 µg/dl (26 µg %) is not considered to be clinically significant in our laboratory.

4.3 Neurological Evaluation

4.31 Preschool Sample (N=10)

The neurological evaluation performed for these Ss was identical to that for the other Ss. However, because other aspects of the study such as the school observations and teacher rating data were not available for this group; results on the preschool Ss are reported separately in this analysis.

The prenatal, birth, and neonatal histories of 8 of these Ss was entirely normal. One child was of normal birth weight, but had developed respiratory symptoms in the neonatal period secondary to an aspiration pneumonitis. No history was available for the second child, adopted at 6-weeks of age. None of the 10 Ss had been hospitalized for either medical illness or accidental injuries since birth. The structured neurological evaluation findings (PANESS) and EEGs were normal for the entire group. Evaluation for "soft" neurological signs demonstrated 3 of the 4-year-old Ss to be ambidextrous and to perform poorly on the stereognosis portion of the PANESS scale. Examination of the remaining 7 children yielded performance entirely within age expectancy.

4.32 School-Age Sample (N=36)

Each of these Ss was in a normal classroom grade for age and was considered to have a normal neurological examination by his private pediatrician. With the exception of drug therapy for behavior, none were taking chronic medications. No Ss had experienced any serious medical illness or had a history of a seizure disorder. The results of the neurological evaluation, excluding "soft" signs in this group of children is summarized in Figure 4.0. The findings have been grouped into history, focal neurological signs, and EEG. The neurological evaluation was considered normal for 14 Ss (38%) whereas at least one abnormality was noted in the remaining 22 Ss (68%). Four Ss had more than one neurological abnormality: One child had asymmetric deep tendon reflexes as well as frontal spike activity on his EEG. Three children had historical abnormalities in addition to an abnormal EEG.

The vast majority of Ss demonstrated one or more of the "soft" neurological signs that have been previously described in hyperactive children (Cantwell, 1975; Ingram, 1973; Werry, et al., 1972). The 43 separate examinations of the PANESS were performed on each S. On many of these examinations all the children received perfect scores. The portions of the PANESS which did provide some discrimination between Ss included: gross motor (Items 21-26); persistence (Items 30-36); graphesthesia (Items 9-16); and, finger tapping speed (Items 37-43). The aggregate raw score for each S was determined on each of these categories. The mean for the entire group was calculated and defined as zero. Each S's score was compared to this mean based upon his chronological age. Thus an individual who

performed better than the mean of the group would have a positive score, whereas an individual who performed more poorly than the mean of the group would have a negative score. These data are grouped according to the neurological evaluation and are shown in Table 4.2 It may be noted that the individuals whose neurological evaluation was normal performed consistently better than the mean of the group, especially on the finger tapping speed task. With the exception of a negative value on finger tapping speed, this trend was also evident for the five Ss whose neurological history was abnormal. For Ss demonstrating more definitive abnormalities in EEG, neurological examination or displaying two abnormalities, larger negative values were found, i.e., relatively more impaired scores in comparison to the group as a whole. The persistence measure and the gross motor category, however, did not follow this pattern for Ss with two abnormalities (history and EEG).

Table 4.0 Deviant Electroencephalogram (EEG) Records for the School-Age and Preschool Groups

SCHOOL-AGE GROUP

Subject Number	EEG Classification*	Description
1	1	Bilateral temporal theta
2	3	Spike, spike or slow wave right hemisphere
4	2	Spike, spike or slow wave left temporal area
9	1	Sharp theta as basic background
24	3	Focal sharp waves right temporal phase reversal T4, T6
26	2	Focal intermittent theta activity left frontal, central
41	3	Paroxysmal sharp slow waves right frontal area
42	2	Left temporal spike phase reversal T3
46	4	Paroxysmal spikes, frontal-central

PRESCHOOL GROUP

13	2	Persistent left occipital slowing

*EEG Classification Code

1 = Borderline abnormal-generalized
2 = Abnormal-left hemisphere
3 = Abnormal-right hemisphere
4 = Abnormal-generalized

Table 4.1 Hematology and Urine Laboratory Results for the School-Age and Preschool Groups

	SCHOOL-AGE GROUP	PRESCHOOL AGE GROUP
HEMATOLOGY		
HGB (gm/100 ml)	N = 34 X = 12.80 SD = .81	N = 6 X = 12.35 SD = .71
HCT (%)	N = 34 X = 38.26 SD = 2.40	N = 6 X = 44 SD = 12.36
WBC	N = 34 X = 6.09 SD = 1.93	N = 6 X = 5.33 SD = 1.28
Pb	N = 33 X = 24.61 SD = 7.69	N = 7 X = 31.14 SD = 6.09

Table 4.0 Deviant Electroencephalogram (EEG) Records for the School-Age and Preschool Groups

SCHOOL-AGE GROUP

Subject Number	EEG Classification*	Description
1	1	Bilateral temporal theta
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PRESCHOOL GROUP

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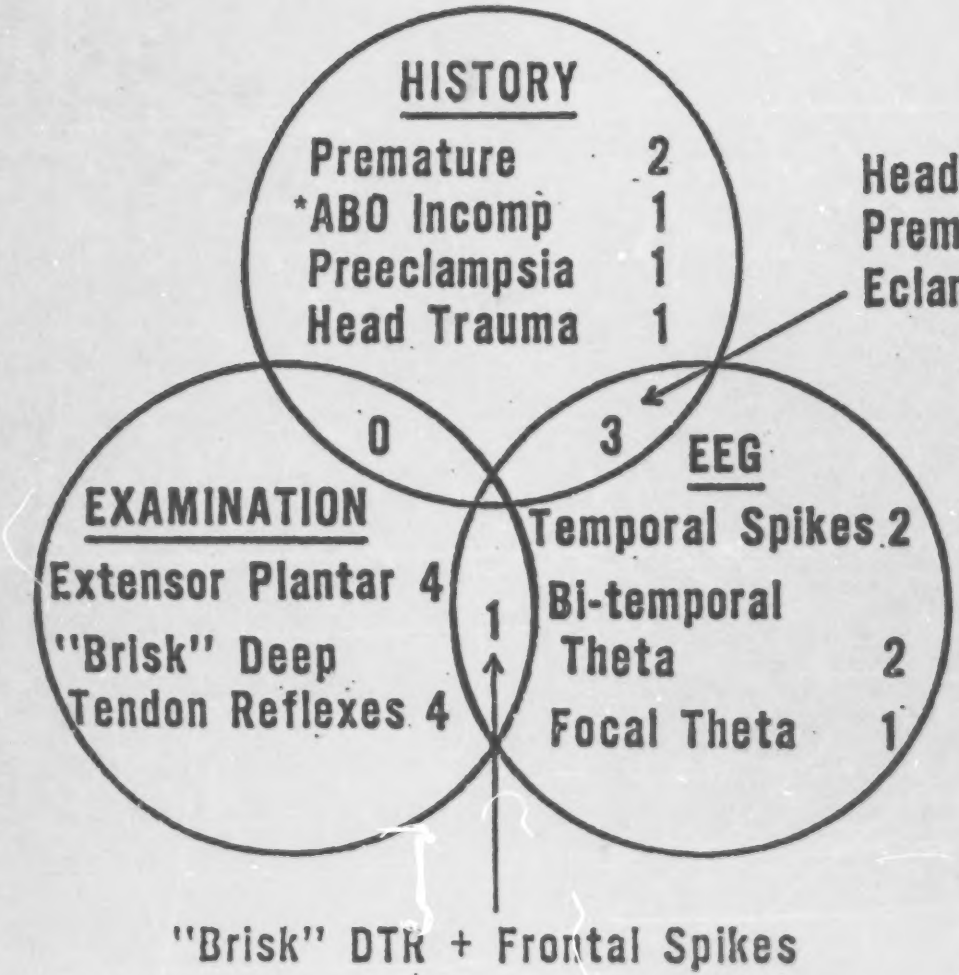
Figure 4.0 Neurological Examination Information for School-Age Group



*ABO Blood Type Incompatibility

Table 4.2 Derived Means of Soft Neurological Signs for the School-Age Group

NEUROLOGICAL EVALUATIONS	GROSS MOTOR	PERSISTENCE	GRAPHAESTHESIA	FINGER TAPPING SPEED
NORMAL (N=14)	0.1	1.2	0.1	5.5
ABNORMAL (N=18)				
HISTORY	0.6	0.0	2.5	-4.2
EEG	-0.8	-3.0	-5.0	-2.4
EXAMINATION	-4.1	-1.6	-4.6	-2.1
TWO-ABNORMALITIES (N=4)	0.0	1.8	-1.3	-8.0

SECTION IV: REFERENCES

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Ingram, T. Soft signs. Developmental Medicine and Child Neurology, 1973, 15, 527-530.

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Rapoport, J. L. and Quinn, P. O. Minor physical anomalies (stigmata) and early development deviation: a major biologic subgroup of "hyperactive children". In R. Gittelman-Klein (Ed.), Recent advances in child psychopharmacology. New York: Human Sciences Press, 1975.

Werry, J., Minde, K., Guzman, A., Weiss, G., Dogan, K. and Hoy, E. Studies on the hyperactive child. American Journal of Orthopsychiatry, 1972, 42, 441-451.

APPENDIX IV

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
NATIONAL INSTITUTE OF MENTAL HEALTH

PHYSICAL AND NEUROLOGICAL EXAMINATION FOR SOFT SIGNS

The Physical and Neurological Examination for Soft Signs (MH-9-41 PANESS) is a 4-page form for the assessment of physical status (pages 1 and 2) and soft neurological signs (pages 3 and 4) in pediatric populations. ***BEFORE ATTEMPTING TO COMPLETE THE FORMS, RATERS SHOULD BE FAMILIAR WITH THE INSTRUCTIONS GIVEN IN THE ECDEU ASSESSMENT MANUAL. THIS IS PARTICULARLY CRUCIAL FOR THE EXAMINATION OF SOFT NEUROLOGICAL SIGNS.***

The neurological examination for soft signs has been developed and copyrighted by Abbott Laboratories and their permission to use it is gratefully acknowledged.

IMPORTANT – PLEASE READ CAREFULLY BEFORE MARKING THIS FORM.

INSTRUCTIONS FOR COMPLETION OF MULTIPLE PAGE FORMS

1. Complete page 1.

2. Following completion of page 1 carefully tear out and remove the pink protective sheet lying between the carbon and your copy of page 2. Follow this procedure for each subsequent page. You must do this to obtain a copy of the data for your files.

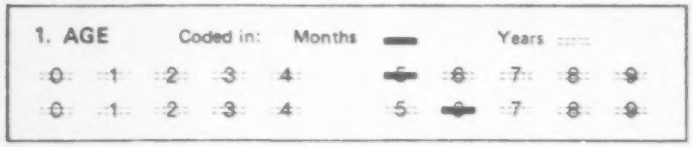
   CAUTION: DO NOT REMOVE PINK PROTECTIVE SHEETS OTHER THAN THE ONE LYING BETWEEN CARBON AND COPY OF THE PAGE YOU ARE ABOUT TO COMPLETE.

3. When you have completed all pages of the form, carefully tear out and remove carbon papers and your copy pages. The machine scannable pages should be left in booklet form for shipment to the Biometric Laboratory in packages prepared according to instructions received from the Biometric Laboratory.

MARKING INSTRUCTIONS

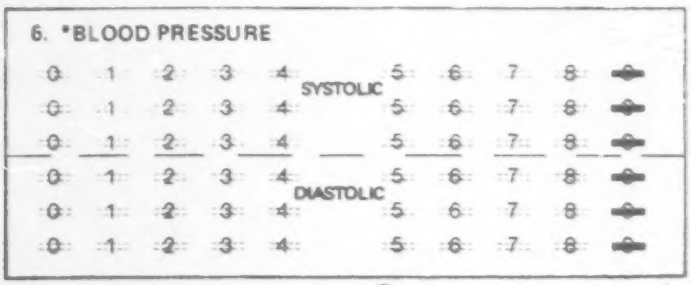
Read each item and its numbered responses. When you have decided which response is correct, blacken the corresponding space on the page with a No. 2 pencil. Do not use a ball point pen. Make your mark as long as the pair of lines, and completely fill the area between the pair of lines. If you change your mind, erase your first mark COMPLETELY.

EXAMPLE: The child is 56 months old. Code as follows:



Mark a field of 9's if an item is unanswered or Not Ascertained.

EXAMPLE: Blood pressure was not taken; the rater codes as follows:



PHYSICAL AND NEUROLOGIC EXAMINATION FOR SOFT SIGNS

PATIENT INITIALS

FIRST INITIAL: A B C D E F G H I J / K L M N O P Q R S T / U V W X Y Z

SECOND INITIAL: A B C D E F G H I J / K L M N O P Q R S T / U V W X Y Z

FORM NUMBER

NUMBER MALES 001-499 FEMALES 500-998

PATIENT: 0 1 2 3 4 5 6 7 8 9

RATER: 0 1 2 3 4 5 6 7 8 9

PERIOD: 0 1 2 3 4 5 6 7 8 9

0 Hours 1 Days 2 Weeks 3 Months 4

PLEASE USE A NO. 2 PENCIL. BE SURE TO MAKE MARKS HEAVY AND DARK. ERASE COMPLETELY ANY MARKS YOU WISH TO CHANGE.

1. AGE — Code in Months (00-11) or Years (01-99)

2. *HEIGHT — Code in Inches (00-99) or Centimeters (001-254)

3. *WEIGHT — Lbs. (000-999) or Kg. (000-454)

4. *HEAD CIRCUMFERENCE — Inches (00-99) or Cm (000-999)

5. *PULSE — Code Per minute (000-999)

6. *BLOOD PRESSURE

7. *VISUAL ACUITY — Code numerator only

RIGHT: 0 1 2 3 4 5 6 7 8 9

LEFT: 0 1 2 3 4 5 6 7 8 9

8. *OPHTHALMOSCOPIC — Normal 0 Abnormal 1 NA 9

9. *AUDIOGRAM — Normal 0 Abnormal 1 NA 9

*HANDEDNESS — Right 1 Left 2 Mixed 3 NA 9

*Specify abnormalities under Item 14

11. **PHYSICAL EXAMINATION** — *Specify any abnormal findings under Item 14*

		Normal	Abnormal	NA
A	HEENT	0	1	9
B	NECK	0	1	9
C	CARDIOVASCULAR	0	1	9
D	PULMONARY	0	1	9
E	LIVER	0	1	9
F	KIDNEY	0	1	9
G	SPLEEN	0	1	9
H	OTHER ABDOMINAL	0	1	9
I	MUSCULOSKELETAL	0	1	9
J	GROSS NEUROLOGIC	0	1	9
K	SKIN	0	1	9
L	HEMATICS	0	1	9
M		0	1	9

12. **Was the neurological examination for soft signs conducted and coded on pages 3 and 4 of this form?**

NO 0 YES 1

BE SURE TO MARK IN PATIENT, RATER AND PERIOD NUMBERS ON THIS PAGE EXACTLY AS YOU DID ON PAGE 1 →

FORM NUMBER

NUMBER MALES 001-499 FEMALES 500-998

PATIENT

RATER

PERIOD

Hours 1 Days 2 Weeks 3 Months 4

13. **PAST MEDICAL HISTORY** – Describe only CONTRIBUTORY illness, accidents, operations, etc.

14. **ABNORMAL PHYSICAL FINDINGS** – Specify all abnormalities noted on physical and GROSS neurologic examination (Item 11). *(Soft signs are coded on page 3 and 4.)*

15. **DIAGNOSIS** – Specify all clinical and neurological diagnoses that apply. (See ICD-9 classifications.)

DO NOT MARK OR WRITE IN THIS AREA

PHYSICAL AND NEUROLOGIC EXAMINATION FOR SOFT SIGNS (PANESS)

BE SURE TO MARK IN PATIENT, RATER AND PERIOD NUMBERS ON THIS PAGE EXACTLY AS YOU DID ON PAGE 1 →

NUMBER MALES 001-499 FEMALES 500-998

PATIENT: 0 1 2 3 4 5 6 7 8 9

RATER: 0 1 2 3 4 5 6 7 8 9

PERIOD: 0 1 2 3 4 5 6 7 8 9

Hours 0 1 Days 2 Weeks 3 Months 4

USE THIS CODE FOR ITEMS 1-20 • SEE INSTRUCTIONS IN ASSESSMENT MANUAL FOR DETAILS

1 — Performed correctly
2 — Performed but not well
3 — Performed poorly or only after repeated instruction and demonstration
4 — Unsuccessful even after repeated demonstration
9 — Not done or not ascertained

1. Touch your finger to your nose	1	2	3	4	9	5. Touch one heel to your other leg	1	2	3	4	9
2. Touch your other finger to your nose	1	2	3	4	9	6. Do the same with your other heel	1	2	3	4	9
3. Close your eyes and touch your finger to your nose	1	2	3	4	9	7. Close your eyes and do it again	1	2	3	4	9
4. Close your eyes and touch your other finger to your nose	1	2	3	4	9	8. Now the other heel	1	2	3	4	9

Child writes name at the top of separate sheet of paper. Trace a "6" in each palm and identify it for the child. Figure is drawn in palm as child would see it. Close your eyes and I will draw a mark on your hand. Now open your eyes and draw it on paper."

9.	□	Right Hand	1	2	3	4	9	13.	×	Right Hand	1	2	3	4	9
10.	×	Left Hand	1	2	3	4	9	14.	3	Left Hand	1	2	3	4	9
11.	O	Right Hand	1	2	3	4	9	15.	O	Right Hand	1	2	3	4	9
12.	□	Left Hand	1	2	3	4	9	16.	3	Left Hand	1	2	3	4	9

"Close your eyes and tell me what I'm putting in your hand."

17.	Coin	Right Hand	1	2	3	4	9	19.	Safety Pin	Right Hand	1	2	3	4	9
18.	Ring	Left Hand	1	2	3	4	9	20.	Key	Left Hand	1	2	3	4	9

SCORING: Count number of errors (more than 3 scored as three). An error is definite deviation from the line or steps incorrectly done

21. Walk the line to the end on your toes	0	1	2	3	9	24. Now hop back on the other foot	0	1	2	3	9
22. Walk back on your heels	0	1	2	3	9	25. Walk to the end this way (show tandem)	0	1	2	3	9
23. Hop on one foot to the end of the line	0	1	2	3	9	26. Now walk backwards the same way (6 steps)	0	1	2	3	9
27. FACE—HAND Brush face and/or hand gently with equal stroke (patient's eyes closed)	0	1	2	3	9						
28. FACE—NOISE Brush face and/or click toy cricket ipsilateral ear (patient's eyes closed)	0	1	2	3	9						
29. Two point discrimination 1 cm. separation, dorsum of digiti minimi	0	1	2	3	9						

PERSISTENCE MEASUREMENTS — Period of uninterrupted success (stopwatch)

	SECONDS						SECONDS				
	20	15-19	10-14	0-9			20	15-19	10-14	0-9	
30. Stick out your tongue until I tell you to stop	1	2	3	4	9	35. Close your eyes and stand still until I tell you to stop	1	2	3	4	9
31. Raise your arms out in front of you until I tell you to stop	1	2	3	4	9	Tendency to fall?		NO 0		YES 1	9
32. Close your eyes until I tell you to open them	1	2	3	4	9	36. Now do it again like this (Demonstrate tandem)	1	2	3	4	9
33. Stand on one foot until I tell you to stop	1	2	3	4	9	Tendency to fall?		NO 0		YES 1	9
34. Now stand on the other	1	2	3	4	9						

PHYSICAL AND NEUROLOGIC EXAMINATION FOR SOFT SIGNS (PANESS)

BE SURE TO MARK IN PATIENT, RATER AND PERIOD NUMBERS ON THIS PAGE EXACTLY AS YOU DID ON PAGES 1, 2, 3 →

FORM NUMBER

NUMBER MALES 001-499 FEMALES 500-998

PATIENT: 0 1 2 3 4 5 6 7 8 9

RATER: 0 1 2 3 4 5 6 7 8 9

PERIOD: 0 1 2 3 4 5 6 7 8 9

0 = hours, 1 = Days, 2 = Weeks, 3 = Months, 4

USE THIS CODE FOR THE QUALITY SECTION OF ITEMS 37 – 42 • SEE INSTRUCTIONS IN ASSESSMENT MANUAL FOR DETAILS

1 – Performed correctly
2 – Performed but not well
3 – Performed poorly or only after repeated instruction and demonstration
4 – Unsuccessful even after repeated demonstration
9 – Not done or not ascertained

SCORING: These are 5 second tests. Always demonstrate with a 4/second beat. Three scores are recorded for each test.

TEST		NUMBER OF TAPS (20 / 15-19 / 10-14 / 0-9)	NUMBER OF MOVEMENTS (if greater than 4, mark 4)	QUALITY
37 Tap this fast with your finger	Left	1 2 3 4 9	1 2 3 4 9	1 2 3 4 9
38	Right	1 2 3 4 9	1 2 3 4 9	1 2 3 4 9
39 Tap this fast with your foot	Left	1 2 3 4 9	1 2 3 4 9	1 2 3 4 9
40	Right	1 2 3 4 9	1 2 3 4 9	1 2 3 4 9
41 Tap with your finger and foot	Left	1 2 3 4 9	1 2 3 4 9	1 2 3 4 9
42	Right	1 2 3 4 9	1 2 3 4 9	1 2 3 4 9

43 **STRING TEST**

Mark the number of times child successfully followed the five patterns

To the left: 1 2 3 4 5
To the right: 1 2 3 4 5

NYSTAGMUS: 1 Not Present, 2 Right, 3 Left, 9

44 **GLOBAL IMPROVEMENT** Rate degree of improvement since admission to the study

1 Much Improved, 2 Minimally Improved, 3 No Change, 4 Minimally Worse, 5 Much Worse, 9 Not Assessed

(At initial rating, mark "Not Assessed")

45 **The conditions of the examination were:** Satisfactory 1 Unsatisfactory 2

SECTION V - Nutrient Analysis

5.1 Introduction

Concern and caution regarding the nutritional adequacy of the experimental (K-P) diet regimen has been expressed by the National Advisory Committee (1975) and the Institute of Food Technologists (1976). Conners, et al. (1976) reported that "The K-P diet produced consistently poorer nutrient intake than the control diet for the baseline period, expecially for Vitamin C. However, the effects were not nutritionally serious inasmuch as the children were still having nutrient intake above the RDA. Long-term consequences of the diet would have to be followed with caution."

The major purpose of the present nutrient analysis (Densmore, 1976) was to assess the general nutritional adequacy of the experimental diet in the fall sample (N=26) of hyperactive school-age children and to determine whether substantial shifts in nutrient intake occurred between the regular baseline and the experimental and control diet conditions.

5.2 Procedures

The parents of the 26 school-age children in the fall group were instructed in the maintenance of daily dietary intake records. These records were kept for the duration of the 10-week study including baseline, experimental, and control dietary periods. The child's mother was shown how to measure edible food portions, to describe method of food preparation and to list ingredients of unusual or nonstandard dishes. Food intake was divided into four categories: breakfast, lunch, supper, and snacks (National Research Council, 1974). Information from the

dietary intake records was coded for nutrient analysis using the system described in U.S.D.A. Home and Garden Bulletin (1972).

Several studies (Beall, 1967; Chalmers, et al., 1952) indicate that dietary records kept for 3 to 7 consecutive days yield reliable nutrient information. In the present study, 7 consecutive days were used for nutrient analysis of diets during the baseline period. The last 14 consecutive days of each dietary period were used for nutrient analysis for the control and experimental diets, a measurement interval based upon recommendations of the Interagency Collaborative Group on Hyperkinesis (1976). The amounts of food eaten were based upon edible portions and recipe conversions. Food items not evaluated in the Nutritive Value of Foods in the Home and Garden Bulletin (1972) were approximated by employing values applied in Food Values of Portions Commonly Used (Church and Church, 1975). Ingredient items not coded or analyzed for nutrient calculations were: water, baking soda, basil, thyme, oregano, bay leaf, paprika, vanilla extract, maple flavoring, nutmeg, cinnamon, clove, and food colors, most of which were not permitted in the experimental design.

Nutrient intake was computed for each individual S for each diet period; i.e., baseline, experimental, and control. The nutrient intake was coded on data cards, with calculations of food energy, protein, carbohydrates, fat, total saturated fatty acids, oleic acid, linoleic acid, calcium, Vitamin A, iron, thiamin, riboflavin, niacin, and Vitamin C, based upon guidelines suggested in U.S.D.A. Home and Garden Bulletin, Nutritive Value of Foods (1972). Nutrient intake was separately analyzed for breakfast, lunch, supper, and snacks. These values were computed vis-a-vis the Recommended Daily Allowance (RDA) to give a percentage of the RDA for each meal (1974). A daily total of intake was also listed

for each nutrient and then computed as the percentage of the RDA based on age and sex for each S.

5.3 Nutrient Intake

Nutrient intake was based upon 7 consecutive days during the baseline period and upon the last 14 days of the control and experimental period. Daily intake was calculated for food energy and ten nutrients: protein, fat, carbohydrate, calcium, iron, Vitamin A, thiamin, riboflavin, niacin and Vitamin C.

Descriptive statistics for nutrient intake during each diet period are presented in Table 5.0. A wide variation between Ss for certain dietary components is apparent from the large standard deviations. These large intra-group differences were noted on baseline, control, and experimental diets.

5.4 Vitamin C

A one-way analysis of variance (ANOVA) was performed to compare nutrient values during the baseline, control, and the experimental diet periods. Vitamin C intake was found to be significantly lower (71.62 mg.) during the experimental diet period than during the baseline period (98.09 mg.), with the control diet assuming an intermediate position (88.98 mg.). The nutrient analysis did not include the 50 mg. of ascorbic acid supplement each child was receiving throughout the study because the primary objective of the analysis was to evaluate the nutritional adequacy of the food consumed by the children under the control and experimental diet conditions. One possible reason for the trend towards a lower intake level of Vitamin C on the experimental diet is that this diet prohibited many primary sources of ascorbic acid usually consumed by children.

The food sources providing high amounts of Vitamin C which were proscribed on the experimental diet were: oranges, orange juice, strawberries, tangerines, nectarines, and tomatoes. Despite the removal of these foods from the diet, it appears that the experimental diet continues to provide adequate Vitamin C amounts and the Vitamin C intake was found to be approximately two times the RDA during each dietary period. The amount of Vitamin C in the experimental diet was similar to that reported by Conners, et al. (1976). The adequate level of Vitamin C ingested indicates that other sources of Vitamin C were readily accepted by these children on the experimental diet. Such food sources of Vitamin C allowed on the experimental diet included: grapefruit, grapefruit juice, pineapple, pineapple juice, lemons, limes, cantaloupes, potatoes, and leafy green vegetables.

Although Vitamin C was found to be the only nutrient to differ significantly between the baseline and the experimental diets, additional nutrient analyses indicated trends towards lower intake levels on the experimental diet as compared to the baseline diet. These included: carbohydrates, protein, calcium, riboflavin, and niacin. The "food energy" calculation also fell slightly below baseline diet values.

A repeated measures ANOVA design was completed to evaluate possible differences between the experimental and control diets with respect to order of dietary treatment. Half the Ss were assigned to a control-experimental diet sequence and the other 13 Ss were given the experimental diet first followed by the control diet. Since the favorable behavioral response to the K-P diet appears to be related to diet order (Conners, et al., 1976) a repeated measures design was used to test whether a significant difference between nutrients consumed on the experimental

versus the control diets could be demonstrated as a function of diet order. Results of this analysis indicated a significant difference in Vitamin C intake between the experimental and control diets. In the diet order control-experimental diet, significantly lower Vitamin C intake was found for the experimental diet.

5.5 Carbohydrates

The amount of carbohydrate ingested was significantly lower ($p < .05$) during the experimental diet than during the control diet, a difference in raw score terms of 31.6 gm. Food items containing large amounts of carbohydrates which were prohibited on the experimental diet were: soda pop, presweetened packaged drink mixes, sweetened cereals, cookies, pies, cakes, flavored gelatins, jam, jelly, candy, chocolate, imitation syrups, and marshmallows. An attempt was made to compensate for the deletion of these foods from the experimental diet by including such items as: specially prepared novelty cakes and candy bars, specific brand name cookies, popcorn, crackerjacks, pretzels, sugar, pure maple syrup, pure honey, Reese's peanut butter cups, and certain fruits and fruit juices. More complex carbohydrates found in various cereal products and vegetables were allowed on both diets.

The gram value of carbohydrates throughout each diet period was within the range considered normal for the average American diet (Page and Friend, 1974). The percentage of calories obtained from carbohydrates was approximately 50 percent of the RDA.

5.6 Thiamin

Thiamin intake was significantly greater on the experimental diet than on the control diet. However, the absolute difference was only 0.1 mg., an increase not considered to be nutritionally significant.

The dietary requirement for thiamin is usually related to caloric intake. With reference to thiamin in the average diet, 0.5 mg./1000 Kcal is suggested for children as the RDA (1974). Based upon an mg./1000 Kcal, thiamin consumption was adequate during the experimental period, since computed values were 0.49 mg./1000 Kcal, 0.43 mg./1000 Kcal, and 0.50 mg./1000 Kcal of thiamin during the baseline, control, and experimental periods, respectively.

5.7 Recommended Daily Allowance

The average group percentage of the Recommended Dietary Allowance (RDA) met by the mean daily intakes for energy and nutrients is presented in Table 5.1. The nutrients and food energy which met 100 percent or more of the RDA, based on age and sex, during each dietary period included the following: energy, protein, calcium, iron, Vitamin A, riboflavin, and Vitamin C. The remaining nutrients, thiamin and niacin, exceeded 90 percent of the RDA.

The distribution of Ss according to the proportion of the RDA met during each of the three diet periods is presented in Table 5.2. A few Ss in the group failed to meet 66 percent of the RDA on one or more nutrients. The nutrients provided in amounts less than 66 percent of the RDA for some Ss were iron, Vitamin A, thiamin, and niacin. The percentage of RDA met by individual Ss during the study is not included because of individual variations in nutrient requirements. The RDA is intended for use in the analysis of diets of groups of individuals (National Research Council, 1974).

Niacin values were based on amounts of preformed niacin in the food consumed and did not account for the amount of niacin available from the conversion of trytophan to niacin (U.S.D.A. Home and Garden Bulletin 1972). Therefore, niacin should not be compared with a dietary standard.

5.8 Energy Consumption

Variations in energy consumption occurred across the three dietary treatment periods. Variations in the level of food energy reflect a redistribution in the percentage of the calories obtained from protein, carbohydrate, and fat from the pretreatment baseline period. The percentage of food energy in the form of protein, fat, and carbohydrate is presented in Table 5.3. The control diet, in contrast to the baseline diet, shows a slight increase in carbohydrate content, a minor decrease in the amount of protein, and no change in total fat consumption.

A slight decrement in the percentage of carbohydrate and a slight increase in the percentage of fat in the diet occurred during the experimental diet period when compared to the baseline and control diets. The caloric distribution for each diet period is similar to the typical dietary distribution of the American diet. The higher than average protein consumption for the baseline period may well reflect the families' above average income level. However, this possible social-economic explanatory factor would apply only minimally if at all for the control and experimental diets, since all foods were provided to the families during these two diet treatment conditions.

5.9 Nutrients Contributed by Breakfast

Several studies (Arvedson, et al., 1969; Tuttle, et. al., 1954) have reported an association between the dietary contribution of breakfast to RDA and mental performance in the mid-morning hours. It has been suggested that at least 25 percent of the Recommended Daily Allowance should be met by the breakfast meal.

Table 5.4 shows that the percentage of the Recommended Daily Allowance contributed by breakfast on all three diets, met or substantially

exceeded the 25 percent guideline on the following nutrients: protein, calcium, riboflavin, and Vitamin C. The breakfast meal under each diet condition met more than 19 percent of the Recommended Daily Allowances for food energy, thiamin, iron, and Vitamin A. Niacin intake was less satisfactory, meeting less than 15 percent of the RDA on all three diets. Table 5.4 also presents the percentage contribution of breakfast to the mean total intake for the group. These data show that a balance of nutrients and energy exceeding 20 percent was provided in all three diet conditions, with the exception of protein and niacin.

5.10 Nutrients Contributed by Snacks

The means and standard deviations for protein, fat, and carbohydrate composition and energy value of snack foods consumed were calculated for a one-week period during the baseline, control, and experimental periods. The results are shown in Table 5.5. The percentage contributed by snack foods to daily intake of energy, protein, fat, and carbohydrate values are presented in Table 5.6. The ranges for the percentage of energy from snacks are 0-26, 3-36, and 7-36 percent during the baseline, and experimental periods respectively.

5.11 Height and Weight Data

Actual pre-study and post-study weight data for the 26 school-age boys in the fall sample are shown in Table 5.7.

The expected weight for Ss was calculated based on height and weight measurements taken during the pretreatment baseline period as shown in Table 5.8. The group mean for percentage of expected weight is 106.38 percent (SD = 15.6), indicating that most Ss met or exceeded their expected weights. Three Ss exceeded 20 percent of their expected

weight, a value generally considered as being indicative of obesity (Albrink, 1971).

The higher than expected weight gain in these three subjects, each of whom was on antihyperactivity medication immediately prior to study onset, might be related to reports by Safer, et al., (1972, 1973), who suggested that a rebound weight gain can occur after medication for hyperkinesis has been terminated.

Table 5.0 Means, Standard Deviations and Ranges of Nutrients for Each Dietary Condition

Nutrients	Baseline Diet		Control Diet		Experimental Diet	
	Minimum Value	Maximum Value	Minimum Value	Maximum Value	Minimum Value	Maximum Value
Calories (Kcal)	1,660.00 (2,492.00)*	3,969.00 (464.50)**	1,862.00 (2,577.00)	3,506.00 (426.30)	1,861.00 (2,464.00)	3,231.00 (378.40)
Protein (gm)	63.20 (96.91)	164.90 (23.58)	71.79 (90.73)	120.90 (13.25)	67.25 (92.06)	127.20 (16.85)
Fat (gm)	64.01 (104.20)	184.80 (26.75)	71.67 (109.00)	146.10 (19.99)	74.14 (108.90)	149.20 (21.27)
CHO (gm)	198.20 (304.10)	434.70 (54.75)	196.00 (322.50)	520.70 (69.08)	196.90 (290.80)	415.00 (49.43)
Calcium (mg)	567.80 (1,327.00)	2,633.00 (415.80)	856.30 (1,237.00)	1,668.00 (235.40)	795.40 (1,224.00)	1,693.00 (259.50)
Iron (mg)	6.21 (12.92)	28.04 (4.29)	9.34 (12.97)	20.44 (2.98)	8.86 (12.50)	16.93 (2.00)
Vitamin A (IU)	2,160.00 (5,103.00)	12,276.00 (2,081.00)	2,993.00 (5,343.00)	7,968.00 (1,261.00)	2,623.00 (5,482.00)	9,006.00 (1,820.00)
Thiamin (mg)	.91 (1.23)	1.94 (.2472)	.80 (1.132)	1.50 (.1838)	.85 (1.24)	1.76 (.2305)
Riboflavin (mg)	1.62 (2.374)	4.21 (.5495)	1.52 (2.122)	2.80 (.3713)	1.55 (2.183)	2.97 (.4291)
Niacin (mg)	9.51 (16.53)	29.53 (4.809)	10.63 (15.34)	19.09 (2.489)	10.57 (15.37)	21.51 (2.798)
Vitamin C (mg)	36.97 (98.09)	199.20 (42.01)	39.05 (88.98)	200.00 (38.37)	31.87 (71.62)	115.10 (21.99)

*Group Mean
**Standard Deviation

Table 5.1 Group Percentage of Standard Deviation for Dietary Periods Versus RDA Guidelines

Nutrients	Baseline Diet		Control Diet		Experimental Diet	
	% RDA	S.D.	% RDA	S.D.	% RDA	S.D.
Kilo-calories	100.87	15.85	105.1	19.89	100.50	16.95
Protein	252.94	62.13	240.72	40.03	246.37	49.40
CHO (gm)	(302.90)	(54.14)	(321.42)	(69.68)	(290.81)	(49.43)
Fat (gm)	(105.99)	(26.18)	(109.10)	(21.90)	(111.56)	(24.85)
Calcium	149.77	40.97	138.36	34.95	135.30	35.44
Iron	112.46	50.47	111.33	35.06	106.81	28.20
Vitamin A	144.38	54.14	151.68	54.59	158.35	64.06
Thiamin	101.26	17.85	92.76	17.27	103.46	21.28
Riboflavin	186.13	39.17	167.14	32.87	168.87	36.41
Niacin	101.77	26.80	94.82	16.97	94.93	19.38
Vitamin C	238.61	96.03	206.75	74.06	173.70	55.96

Table 5.2 Distribution of Subjects Meeting RDA Levels During the Three Diet Periods (N=26)

% RDA	Cal.	Pro.	Calc.	Iron	Vit A	Thia.	Ribo.	Nia.	Vit C
Baseline Dietary Period									
>100%	13	26	23	16	20	15	26	12	25
67-100%	13	0	3	5	4	9	0	12	1
<66%	0	0	0	5	2	2	0	2	0
Control Dietary Period									
>100%	16	26	23	17	22	8	26	13	23
67-100%	10	0	3	8	2	17	0	11	3
<67%	0	0	0	1	2	1	0	2	0
Experimental Dietary Period									
>100%	12	26	23	15	20	12	26	11	23
67-100%	14	0	3	8	3	14	0	13	3
<66%	0	0	0	3	3	0	0	2	0

Table 5.3 Percentage of Caloric Distribution from Protein, Carbohydrate and Fat

Nutrients	Baseline Diet	Control Diet	Experimental Diet
Protein (%)	15	14	14
Fat (%)	37	37	39
CHO (%)	48	49	47
Actual Calories (kcal)*	2492	2577	2464
Adjusted Calories (kcal)**	2534	2634	2512

* Computed from food values of composition of food.
** From physiological fuel values for conversion
1 gm protein yields 4 kcal
1 gm fat yields 9 kcal
1 gm CHO yields 4 kcal.

Table 5.4 Percentage Contribution of Breakfast to the Total Intake and to the RDA and Standard Deviation for the Group During Each Diet Period

Nutrients (%)	Baseline Diet		Control Diet		Exp. Diet	
	% Total Intake	S.D.	% Total Intake	S.D.	% Total Intake	S.D.
Kilocalories	20.19 (20.67)*	4.80 (4.52)**	21.26 (21.59)	5.05 (5.94)	21.11 (21.18)	5.11 (6.36)
Protein	16.34 (41.77)	4.46 (14.62)	16.03 (37.07)	4.71 (13.41)	15.96 (38.92)	5.25 (16.16)
Fat	16.73	6.56	15.84	5.19	15.69	7.36
Carbohydrate	22.87	8.79	26.92	6.76	27.51	7.56
Calcium	24.50 (35.03)	8.00 (14.84)	24.80 (32.29)	7.89 (11.07)	26.53 (33.77)	16.43 (18.92)
Iron	20.03 (23.88)	10.40 (27.34)	21.46 (24.51)	9.14 (19.38)	20.76 (23.18)	7.70 (12.46)
Vitamin A	20.25 (25.46)	12.30 (14.25)	15.15 (19.55)	8.06 (9.11)	13.11 (19.07)	6.91 (10.86)
Thiamin	26.53 (34.22)	7.08 (37.00)	30.34 (27.55)	8.86 (27.55)	21.57 (21.92)	6.03 (7.87)
Riboflavin	21.73 (49.17)	6.74 (25.88)	22.61 (36.96)	6.19 (12.76)	22.23 (39.39)	8.50 (18.43)
Niacin	15.76 (14.62)	9.96 (6.61)	12.69 (11.67)	3.78 (4.26)	11.34 (13.39)	3.98 (14.48)
Vitamin C	37.42 (91.67)	24.44 (79.91)	42.53 (89.29)	18.06 (49.75)	34.96 (63.46)	12.01 (26.17)

*The values in parentheses under % Total Intake indicates % RDA.
**The values in parentheses under S.D. indicate the S.D. calculated for the % RDA met by the group.

Table 5.5 Group Means for Calories, Protein, Fat and CHO Composition of Snacks and Average Frequency of Snacks per Week During Each Diet Period

Nutrients	Baseline Diet Means	Baseline Diet S.D.	Control Diet Means	Control Diet S.D.	Exp. Diet Means	Exp. Diet S.D.
Calories (kcal)	391.80	181.93	451.76	243.54	417.52	216.73
Protein (gm)	9.83	5.93	9.63	9.00	9.92	8.45
Fat (gm)	12.30	8.61	17.03	12.03	15.85	10.86
CHO (gm)	61.97	30.31	65.88	32.62	60.83	30.49
Frequency/wk.	3.26	2.18	5.30	1.90	4.15	1.86
Adjusted Calories (kcal)	397.90		455.31		425.65	

Table 5.6 Mean Percentage of Average Daily Nutrient Intakes Contributed by Snacks

Nutrients	Baseline Diet	Control Diet	Experimental Diet
Calories (%)	15	17	17
Protein (%)	10	10	10
Fat (%)	11	15	14
Carbohydrate (%)	20	20	20

Table 5.7 Prestudy and Poststudy Weights of the School-Age Group

Subject No.	Prestudy Weight (lbs)	Poststudy Weight (lbs)
1	76	33
2	123	139
3	85	93
4	100	115
5	50	58
6	95	96
7	68	75
8	60	66
9	83	--
10	91	75
11	61	67
12	56	63
13	59	64
14	79	89
15	90	104
16	72	77
17	93	104
18	57	66
19	64	72
20	45	51
21	63	66
22	86	90
23	69	78
24	114	117
25	55	60
26	55	60

Table 5.8 Expected Weight for Height of Subjects Based on Baseline Height and Weight Measures

Subject Code No.	Age		50th Percentile[1]			Present[2]		Expected[3]	% Expected Wt.[4]
	Yr.	Mo.	Ht.(in)	Wt.(lb)	Ht/Wt Ratio	Ht.(in)	Wt.(lb)	Wt.(lb)	%
1	9	2	53.3	66	.80	55	76	68.75	110
2	11	9	57.8	81	.71	62	123	87.32	140
3	10	9	56.0	74.8	.74	55	85	74.32	114
4	12	10	60.0	88.7	.64	60	100	89.55	111
5	6	2	46.3	48.3	.95	47	50	49.47	111
6	12	4	58.9	84.4	.69	58	95	86.56	109
7	9	6	54.3	69.0	.78	51	68	65.38	103
8	10	6	56.0	74.8	.74	52	60	70.27	85
9	9	6	54.3	69.0	.78	54	83	69.23	119
10	12	10	60.0	88.7	.67	62	91	92.53	98
11	7	6	50.0	57.1	.87	51	61	58.62	104
12	7	2	48.9	54.1	.90	49	56	54.44	102
13	7	9	50.0	57.1	.87	51	59	58.62	99
14	11		56.8	77.6	.73	57	79	78.08	101
15	12	9	60.0	88.7	.67	57	90	85.07	105
16	9	6	54.3	69.0	.78	55	72	70.51	102
17	12	5	60.0	88.7	.67	50	93	74.62	124
18	8	10	52.3	63.1	.82	53	57	64.63	88
19	7	10	50.0	57.1	.87	53	64	60.91	105
20	6	1	46.3	48.3	.95	47	45	49.47	90
21	8		51.2	60.1	.85	53	63	62.35	101
22	10	1	55.2	70.9	.76	58	86	76.31	112
23	10		55.2	71.9	.76	56	69	73.68	94
24	10	7	56.0	44.8	.74	54	114	72.97	156
25	7	10	50.0	57.1	.87	50	55	57.47	95
26	8	10	52.3	63.1	.82	51	55	62.19	88

[1]From V. C. Vaughan, Nelson's Textbook of Pediatrics (10th ed.; Philadelphia: W. B. Saunders Co., 1975), pp. 44-45.

[2]Taken during baseline. [3]Present ht.÷ht/wt ratio. [4]Present wt.÷exp. wt.X 100.

99

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SECTION VI - Classroom and Laboratory Observations

6.1 Introduction

Descriptions of hyperactivity in the school-age child commonly make reference to attentional deficits including distractibility/impulsivity, to high levels of activity reflected in excessive movement or restlessness, and to situationally inappropriate acting out behaviors (Douglas, 1972; Werry, 1968; Werry and Sprague, 1970). These behaviors are of obvious importance in classroom performance and should be assessed in any study which attempts to evaluate the effectiveness of treatment programs for hyperactive children.

Although there is general concensus regarding the importance of the classroom setting, there have been relatively few studies which have attempted to determine the specific classroom behaviors which differentiate hyperactive and nonhyperactive children or which characterize the successful treatment of hyperactivity. Studies of hyperactivity within school settings have relied primarily on the use of behavior checklists employed by teachers (Werry, Sprague, and Cohen, 1975; Minde, Lewin, Weiss, Lazigeuer, Douglas, and Sykes, 1971). A small number of studies have used behavior observations in classrooms to evaluate drug treatment or behavior modification approaches to altering hyperactivity (Ayllon, Layman, and Kandel, 1975; Sprague, Barnes, and Werry, 1970).

The observational studies which have attempted to determine classroom behaviors which differentiates hyperactive and nonhyperactive groups have suggested that hyperactive children are characterized by higher levels of off-task behavior, movement, and situationally inappropriate behaviors such as aggression (Jones, Loney, Weissenberger,

and Fleischman, 1975; Schliefer, Weiss, Cohen, Elman, Cvejic, and Kruger, 1975).

A number of observational coding systems have been developed for initial assessment or treatment evaluation in classroom settings (Nelson, 1971; Patterson, Cobb, and Ray, 1972; Werry and Quay, 1969). Utilization of these or similar coding systems in studies of hyperactivity provides a relatively objective source of classroom data for the evaluation of innovative treatment programs.

The observational study reported here has two primary aims:

1) to determine whether hyperactive and nonhyperactive Ss may be differentiated on the basis of behaviors observed in the classroom, and
2) to evaluate the effectiveness of the experimental diet in terms of changes observed in those specific behaviors which differentiate hyperactive from nonhyperactive Ss.

6.2 Procedure for Classroom Observations

6.21 Subjects

Observational data were obtained in the regularly-assigned school classrooms for 34 of the 36 school-age hyperactive Ss and for 34 matched control Ss. The classroom teacher of each hyperactive boy assisted the experimenters in selecting a control S who could be described as average for the classroom in attention/concentration and activity level and as similar to the hyperactive S in age, family composition, and estimated academic potential. Teachers were encouraged to nominate "average" boys rather than "model students" or "problem children." Most teachers reported

no difficulty in selecting one or more boys as appropriate control Ss on the basis of these selection criteria.

6.22 Observation Setting

Classroom observation sessions took place throughout the course of the study with an average of three data collection points per week for each S. An attempt was made to obtain a representative sample of classroom activity settings and times of day for each S by including group and individual work assignments, structured and unstructured activity settings, and both morning and afternoon classes. In each setting, hyperactive and control Ss were observed for alternating five-minute intervals in order to avoid the confounding of behavior patterns by classroom activities which may occur when Ss were observed at different points in time.

6.23 Observation Code

A fixed-category coding system allowing for the sequential and coincident recording of the frequency and/or duration of multiple behaviors and behavior-states was developed for this study (Ray, Kantosky, Clement, and Morse, 1975). The development of this procedure was based upon extensive experience in the use of classroom behavior coding systems (Patterson, Cobb, and Ray, 1972; Ray, 1976) and upon a review of existing systems for the coding of the behavior of hyperactive children (e.g., Werry and Quay, 1969). In contrast to earlier category systems, the coding procedure used in this study included a wider variety of activity or movement categories, peer as well as teacher interaction categories, and a means of obtaining measures of the duration of behaviors in addition to simple frequency counts.

The coding system includes four major summary categories reflecting dimensions of classroom behavior commonly assumed to characterize hyperactivity. These categories are:

A. Attending-To-Task: The proportion of total observed time attending to any classroom activity defined as appropriate by the teacher. Observers were instructed to assume an attending state except when the S was engaged in an activity specifically defined as inappropriate or was not attending to any classroom activity, e.g., staring out a window during a penmanship exercise.

B. Shifts in Attending: The rate per minute of observation of shifts in focus of attending from one classroom activity to another, one set of materials to another, etc. This category was developed in an attempt to quantify the concept of distractibility by noting the frequency with which the S altered the nature of his activity or the apparent object of his attending behavior.

C. Restless Activity: The proportion of total observed time the S is seen to engage in such activities as repetitive finger tapping, twirling objects, noninstrumental movement of the arms or legs, turning in the chair and looking about while seated at the desk or other work stations. This composite category was developed in an attempt to quantify the behavioral dimension commonly described as aimless movement or fidgeting.

D. Disruptive Activity: The rate per minute of observation of movement about the classroom specifically defined as

inappropriate by the teacher, interpersonal aggression, destruction of objects, excessive noise, and interactions with the peers or teacher during periods of non-attending. This composite category was defined to include specific behaviors of a situationally inappropriate nature which have been assumed by a number of researchers to be the initial reasons for the referral of the hyperactive child.

6.24 Observers

Classroom data were collected by a team of observers trained to use the coding system in a series of laboratory, video-tape, and field (classroom) training exercises. Observers were initially trained to a predetermined level of criterion accuracy; inter-observer agreement checks and criterion retraining sessions were held throughout the study.

Observers were not informed of the study design nor of the hypothesis to be tested. Observers were informed only that they would be recording the behavior of two children in each of several classrooms over a period of several weeks. All necessary communications with school personnel regarding scheduling of observations, dietary noncompliance, or other issues which might compromise the uninformed status of the observers were conducted by observation team supervisors. Observers who collected data on both the spring and fall samples were not informed of the identity of the hyperactive Ss even though they may have been made aware of the topic of the study as a function of information available in the public press.

6.3 Results of Classroom Observations

6.31 Design of Analysis

The code category means of the several observations for each S during each time period (Baseline, Diet Period 1, Diet Period 2) or diet period (Experimental, Control) were the data points entered into these analyses. Each test took the form of a two-factor analysis of variance with repeated measures on one factor (Winer, 1971).

Two major analyses were performed for each of the four observation code categories. The first set of analyses was performed to determine differences in behavior between the groups of hyperactive and control Ss and among time periods. The second set of analyses was performed to assess the effects on the behavior of the hyperactive Ss of the diet manipulation and of the diet sequence to which Ss were assigned.

6.32 Comparison of Hyperactive and Control Ss, Time Periods

For each observation category, Table 6.0 provides the means and standard deviations of the hyperactive and control S groups during each time period of the study.

Significant differences between the hyperactive and control Ss were found for each of the four behavior categories:

A. Attending-To-Task F (1,66) = 17.892, $p < .001$

B. Shifts in Attending F (1,66) = 5.597, $p < .025$

C. Restless Activity F (1,66) = 5.329, $p < .025$

D. Disruptive Activity F (1,66) = 16.222, $p < .001$

A significant main effect for time period was found only in the behavior category, Shifts in Attending, where F (2,132)= 29.612, $p < .001$. This effect reflects a drop in the rate of

Shifts in Attending following the Baseline period in both S groups. Finding of this main effect suggests the possibility of an early phase of reactivity to the observational process common to both groups of Ss. No evidence was found in these analyses for other decreases or increases in levels of observed behavior over time, nor were there any statistically significant interactions of group membership and time period.

It is clear from these results that the behaviors of the hyperactive Ss differ significantly from the classroom behaviors of the nonhyperactive control Ss. The hyperactive Ss spend less total time attending to appropriate classroom activities and greater proportion of total time in restless or fidgety behavior. Hyperactive Ss engage in a higher rate of shifts from one activity or focus of attending to another, and exhibit a higher rate of situationally inappropriate or disruptive behaviors. These findings of significant differences between the S groups on behavioral dimensions thought to characterize hyperactivity are also found to be stable differences over a period of at least 8 to 10 school weeks. Taken together, these findings suggest that, if the dietary manipulation tested in this study is effective in altering the observable behaviors characteristic of hyperactivity, this effect should be evident in the analysis of variance for the Experimental and Control Diets.

6.33 Effects of Diet and Diet Sequence

For each observation category, Table 6.1 provides the means and standard deviations of the hyperactive Ss assigned to the

Experimental-Control diet sequence and those assigned to the Control-Experimental sequence for the Experimental Diet period and for the Control Diet period.

Results of the analyses of variance reveal no statistically significant differences between the Experimental and the Control Diet for any of the behaviors observed to differentiate the hyperactive and control populations. No effects of diet sequence were found, nor were any significant interactions of diet and diet sequence detected in this analysis of multiple behavior categories.

Although the classroom observation data reveal significant differences in the behaviors of hyperactive and nonhyperactive Ss, no significant changes in these observable symptoms are produced by the dietary manipulations tested in this study.

6.4 Procedure for Laboratory Task

6.41 Subjects

To control the variability of behavior across different classroom settings, 22 of the 36 hyperactive Ss and 16 nonhyperactive control Ss were observed in a laboratory task. Eleven of the 16 control Ss had also served as control Ss in the classroom observations. The additional five laboratory control Ss were members of the same school classrooms and were selected by their teachers on the basis of the same matching criteria; they were not observed in the classroom because there was not sufficient class time or observer time to include more than two Ss in each class.

6.42 Laboratory Task Setting

The setting for the laboratory activity task is presented schematically in Figure 6.0. Measures of activity level and

attending-to-task in a laboratory setting have been used in developmental and clinical studies of children by a large number of investigators. The setting utilized in this study was similar to that described by Routh and his colleagues (Routh, Schroeder, and O'Tuama, 1974; Routh and Schroeder, 1976) who have studied the activity levels of groups of children, including hyperactive Ss.

Each of the Ss was observed in the laboratory or "grid room" under two different sets of instructions. During one fifteen-minute period the child was told that he might do whatever he wished in the "playroom" and play with whatever of the toys placed on the tables that he might wish to play with. At the end of this free instructional period, restricted instructions were presented for the next fifteen-minute period. During this time, the child was instructed to sit at a specific table and occupy himself for the time period with only one of the several toys available at the table. Throughout the laboratory task, observers recorded the duration of time the S attended to the one toy specified.

6.43 Data from Laboratory Task

Hyperactive Ss were observed in the laboratory setting during the Baseline period and at the end of each Diet period. Control Ss were observed during the Baseline period only.

Three scores were obtained for each S. Attending-To-Task was recorded as the proportion of total observation time the S spent looking at, touching, or playing with the specified toy during the restricted period. Locomotor Activity ("Grid Crossings") was

recorded as the rate per minute of crossing into segments of the floor grid. Locomotor Activity was recorded for free and restrictive periods.

6.44 Observers

A separate team of observers collected data on the hyperactive and control Ss in the laboratory setting. The observers were not informed of the hypotheses of the study or of the hyperactive or control status of the Ss they observed.

6.5 Results of the Laboratory Task

6.51 Comparison of Hyperactive and Control Groups

For each laboratory observation category, Table 6.2 provides the means and standard deviations for the hyperactive and control S groups. Data from the laboratory study provided support for the validity of the classroom observations. The rate of Locomotor Activity and the proportion of time spent in Attending-To-Task differed significantly for the hyperactive and control samples. Hyperactive Ss moved about the laboratory room at a significantly higher rate than the control Ss during both free and restricted periods. Hyperactive Ss also spent significantly less time attending to the specified task during the restricted period.

6.52 Comparison of Experimental and Control Diets

In this analysis also, the results of the laboratory study parallel the results of the classroom observations (Table 6.3). Comparison of the Experimental and Control Diets reveals no significant difference in the rates of Locomotor Activity or time spent

Attending-To-Task. The dietary manipulations evaluated in this study were found to have no significant effect on the behaviors of the hyperactive Ss as observed in either the classroom or laboratory setting.

Table 6.0 Means and Standard Deviations of Observation Code Categories for Hyperactive and Control Subjects During Three Observation Periods

OBSERVATION CODE CATEGORY		OBSERVATION PERIOD BASELINE	DIET PERIOD 1	DIET PERIOD 2
ATTENDING-TO-TASK				
Hyperactive Ss	$\bar{X}$	.785	.805	.791
	SD	.092	.104	.090
Control Ss	$\bar{X}$	.836	.868	.862
	SD	.085	.064	.071
SHIFTS IN ATTENDING				
Hyperactive Ss	$\bar{X}$	.942	.705	.689
	SD	.346	.239	.281
Control Ss	$\bar{X}$	.847	.577	.579
	SD	.302	.172	.223
RESTLESS ACTIVITY				
Hyperactive Ss	$\bar{X}$	.413	.416	.413
	SD	.141	.102	.115
Control Ss	$\bar{X}$	.363	.372	.356
	SD	.138	.101	.119
DISRUPTIVE ACTIVITY				
Hyperactive Ss	$\bar{X}$	.309	.383	.372
	SD	.192	.327	.243
Control Ss	$\bar{X}$	.186	.171	.190
	SD	.142	.139	.141

Table 6.1 Means and Standard Deviations of Observation Code Categories for Hyperactive Subjects by Diet Sequence Assignment for Experimental and Control Diets

OBSERVATION CODE CATEGORY		EXPERIMENTAL DIET	CONTROL DIET
ATTENDING-TO-TASK			
Diet Sequence EXP-CNT	$\bar{X}$	.799	.768
	SD	.109	.114
Diet Sequence CNT-EXP	$\bar{X}$	.792	.810
	SD	.062	.103
SHIFTS IN ATTENDING			
Diet Sequence EXP-CNT	$\bar{X}$	.749	.697
	SD	.221	.251
Diet Sequence CNT-EXP	$\bar{X}$	.681	.666
	SD	.312	.254
RESTLESS ACTIVITY			
Diet Sequence EXP-CNT	$\bar{X}$	.406	.415
	SD	.111	.127
Diet Sequence CNT-EXP	$\bar{X}$	.411	.425
	SD	.107	.096
DISRUPTIVE ACTIVITY			
Diet Sequence EXP-CNT	$\bar{X}$	.386	.374
	SD	.282	.272
Diet Sequence CNT-EXP	$\bar{X}$	.369	.380
	SD	.222	.371

Figure 6.0 Schematic of Laboratory Observation Room

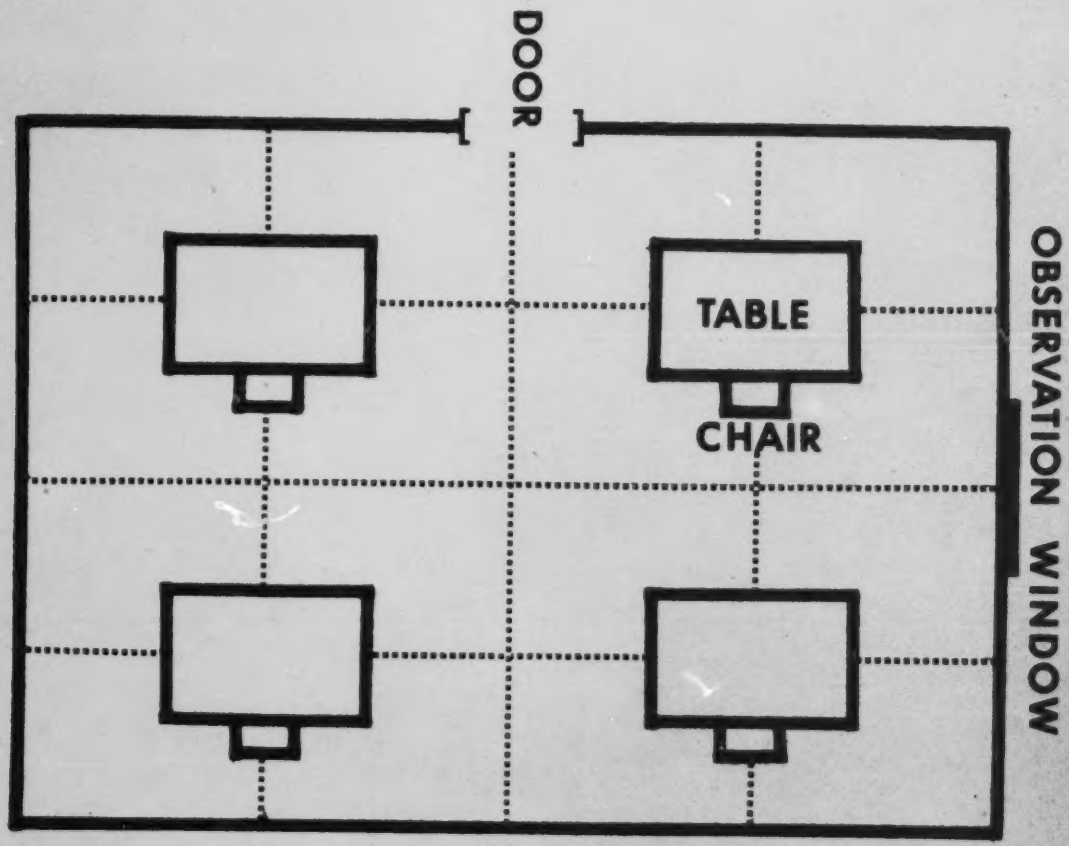

Table 6.2 Means and Standard Deviations of Laboratory Observation Categories for Hyperactive and Control Subjects

LABORATORY OBSERVATION CATEGORY		SUBJECTS HYPERACTIVE	CONTROL
ATTENDING-TO-TASK (RESTRICTED)	$\bar{X}$	.682[1]	.883
	SD	.271	.092
LOCOMOTOR ACTIVITY (FREE)	$\bar{X}$	1.102[1]	.356
	SD	1.250	.422
LOCOMOTOR ACTIVITY (RESTRICTED)	$\bar{X}$	.419[1]	.161
	SD	.688	.171

[1]Hyperactive vs. Control Subjects, $p < .05$

Table 6.3 Means and Standard Deviations of Laboratory Observation Categories for Hyperactive Subjects for Experimental and Control Diets

LABORATORY OBSERVATION CATEGORY		DIETS EXPERIMENTAL	CONTROL
ATTENDING TO TASK (RESTRICTED)	$\bar{X}$	.651	.651
	SD	.228	.249
LOCOMOTOR ACTIVITY (FREE)	$\bar{X}$	.939	1.548
	SD	1.337	2.302
LOCOMOTOR ACTIVITY (RESTRICTED)	$\bar{X}$	.743	.456
	SD	.158	.047

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SECTION VII - Reaction Time

7.1 Introduction

Reaction time (RT) tasks have been employed by a number of investigators to ascertain the adequacy of cerebral functioning in adults (DeRenzi and Faglioni, 1965; Blackburn and Benton, 1955; Miller, 1970) and in children (Czunder and Rourke, 1972).

RT has been found to be slower for hyperactive than control children (Cohen and Douglas, 1972; Grunewald-Zuberbeir, Grunewald, and Rasche, 1975) and to improve (i.e., shorter latency) when stimulant medication is given to hyperactive Ss (Cohen, Douglas and Morgenstern, 1971; Sprague, Branes, and Werry, 1970; Sykes, et al., 1972; Spring, et al., 1973). It is generally agreed that the resultant shorter response latencies reflect the S's ability to sustain attention, with greater inhibition and better response organization.

7.2 Procedure

S was seated in front of a table on which is placed a panel containing eight yellow response buttons equally spaced in a semicircular pattern, with a single red button located in a center position (Figure 7.0). Each S completed the RT procedure on three separate occasions: at the end of baseline and at the conclusion of both diet periods.

The RT test consisted of three successive series of 16 RT trials each: one-choice, two-choice, and four-choice RT. In the one-choice condition S kept his preferred hand on the table and was told to "push the center button as fast as you can when the red light comes on". (The examiner gives a demonstration). The index finger of the preferred hand was used to depress the button in all three choice conditions. In

the two-choice condition, yellow buttons 1 and 8 were randomly illuminated an equal number of times. In the four-choice condition buttons 1, 3, 6 and 8 were utilized. In both the two and four-choice conditions the red center button was used as the "home' or resting position for S's hand. Approximately 30 sec. intervened between each RT choice condition.

In each RT condition the light in the response button was immediately terminated by S's response. If S failed to respond within 3 sec. the stimulus light was automatically terminated. Response latency was recorded to the nearest millisecond by an ADS-1800A laboratory computer and a printer located in an adjoining room. A 2 sec. auditory stimulus, delivered via head phones, preceded each RT light stimulus. The warning stimulus interval ranged from 2 to 8 sec. ($\bar{X}$ = 5 sec.), and the mean intertrial interval was 16 sec. for the three RT conditions. The procedure was similar to that described by previous investigators (Bruhn and Parsons, 1971; Miller, 1970).

7.3 Results

The first four trials of each of the three RT choice conditions were considered warm-up/practice trials and were not included in the subsequent analyses. The hyperactive and control Ss were compared at baseline by a 2x3x6 (GROUP x CHOICE x TRIALS) analysis of variance (ANOVA). Response latencies were significantly longer for the hyperactive (Figure 7.1) as compared to the control group (Figure 7.2) at baseline; F (1,43) = 4.26, $p < .05$. Increasing number of possible response alternatives resulted in longer RTs for both groups of Ss, F (2,86) = 22.44, $p < .001$. The interaction of Choice x Trails was also found to be significant, F (10,430) = 2.21, $p < .05$.

The last 12 trials of each RT condition were analyzed in blocks of two trials. A 2x2x3x6 ANOVA was carried out for the school-age group (N=35). The factors of the ANOVA were: Diet, Diet Order, RT Choice, and Trial Blocks.

No significant effect of Diet, Diet Order, Trials, or their interactions were obtained ($p > .05$). Response latencies, however, were longer with increases in task complexity, F (2,68)=34.23, $p < .001$. The mean response latencies are shown in Table 7.0 for the experimental and control diet conditions for each of the RT choice conditions.

A 2x3x3x6 (GROUP x CHOICE x TESTING x TRIAL) ANOVA was performed on the school-age controls and the hyperactive children receiving the diet sequence of control-experimental diet. The mean response latencies of the experimental and control groups for the three testings are given in Figure 7.3-7.5 respectively. The control Ss had faster RTs than the hyperactive group [F (1,27)=4.09, $p < .05$] and longer latencies were found for the more complex RT conditions, [F (2,54)=57.33, $p < .001$] for both groups. Significant interactions were obtained for Choice x Trial [F (10, 270)=2.51, $p < .01$] and Group x Choice x Testing F (4,108)=2.60, $p < .05$.

An identical ANOVA was used to compare the control group with the hyperactive children (N=17) receiving the other diet order; experimental-control diet. As was found in the preceding analysis, the RTs of the control S were quicker than the hyperactive sample, [F (1,24)=5.81, $p < .05$] and the main effect of Choice was again significant [F (2,48)= 31.84, $p < .001$]. The mean response latencies for the experimental (EXP/CNT diet order) and control groups are displayed in Figure 7.6

If S failed to make a response within 3 sec. after stimulus onset the light terminated automatically. Table 7.1 presents the frequency

and percentage of failures to respond within the allowed time limit. The hyperactive Ss had proportionately approximately two to three times as many failures to respond than the control Ss.

In summary, comparison of the RTs for the school-age hyperactive children for the control versus experimental diet conditions did not reveal a significant change. The hyperactive Ss did, however, exhibit significantly slower RTs than the control group, and increased task complexity (i.e., more response alternatives) resulted in slower RTs for both groups of Ss.

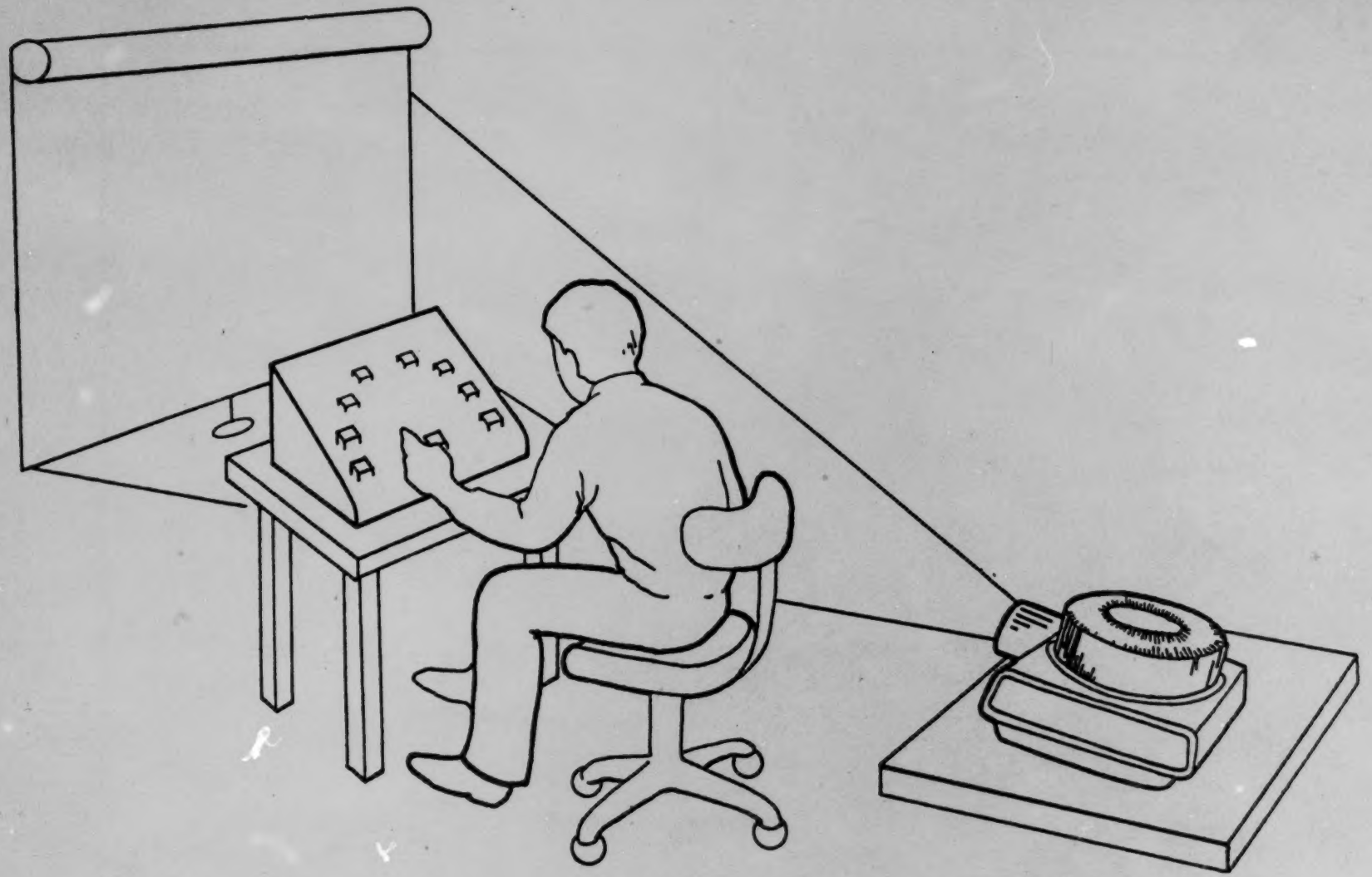

Figure 7.0 Illustration of Subject Seated at Continuous Performance Test and Reaction Time Tasks

143

144

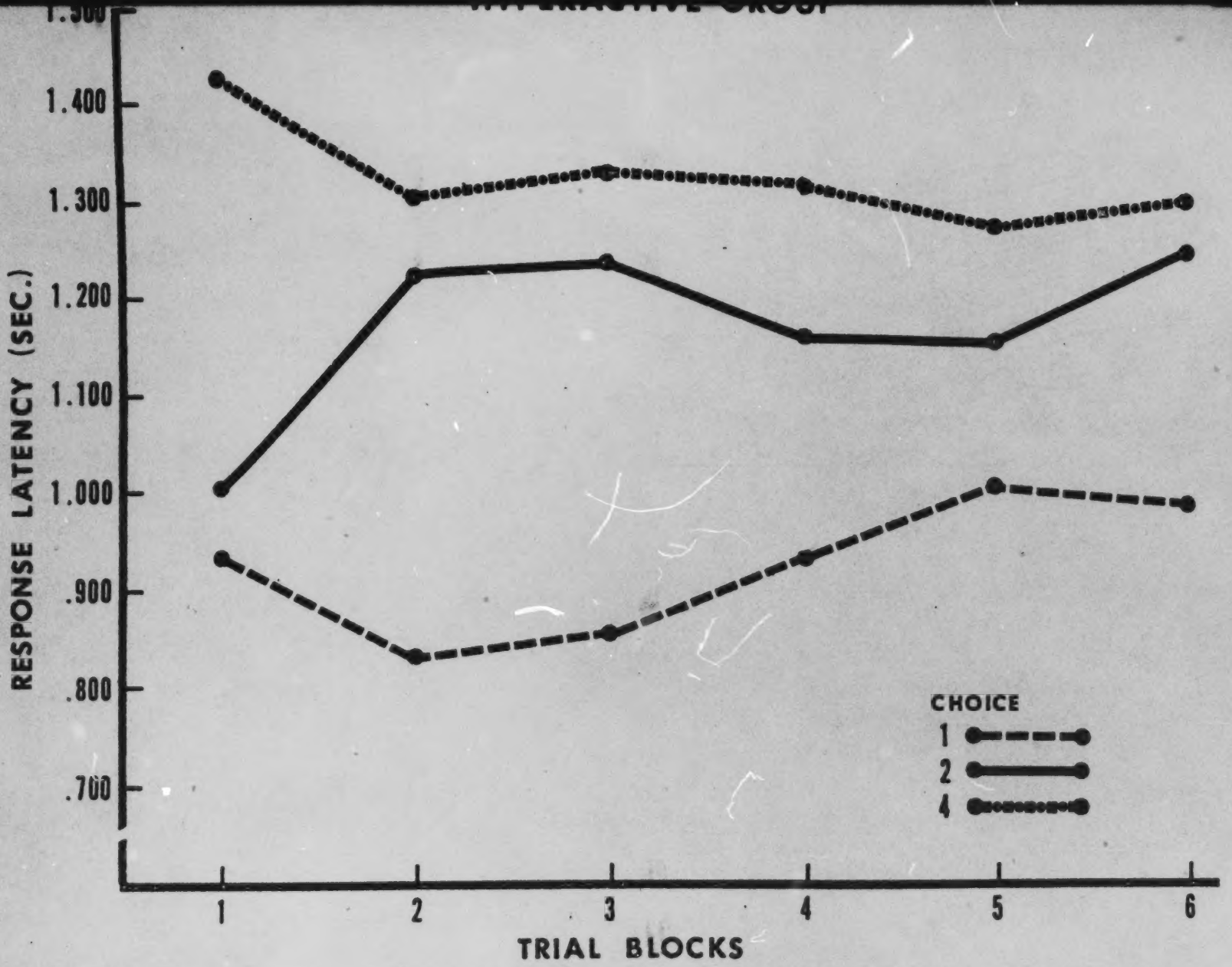

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Figure 7.1 Mean RT Latency Across Trial Blocks by Choice Condition for the Hyperactive Subjects at Baseline

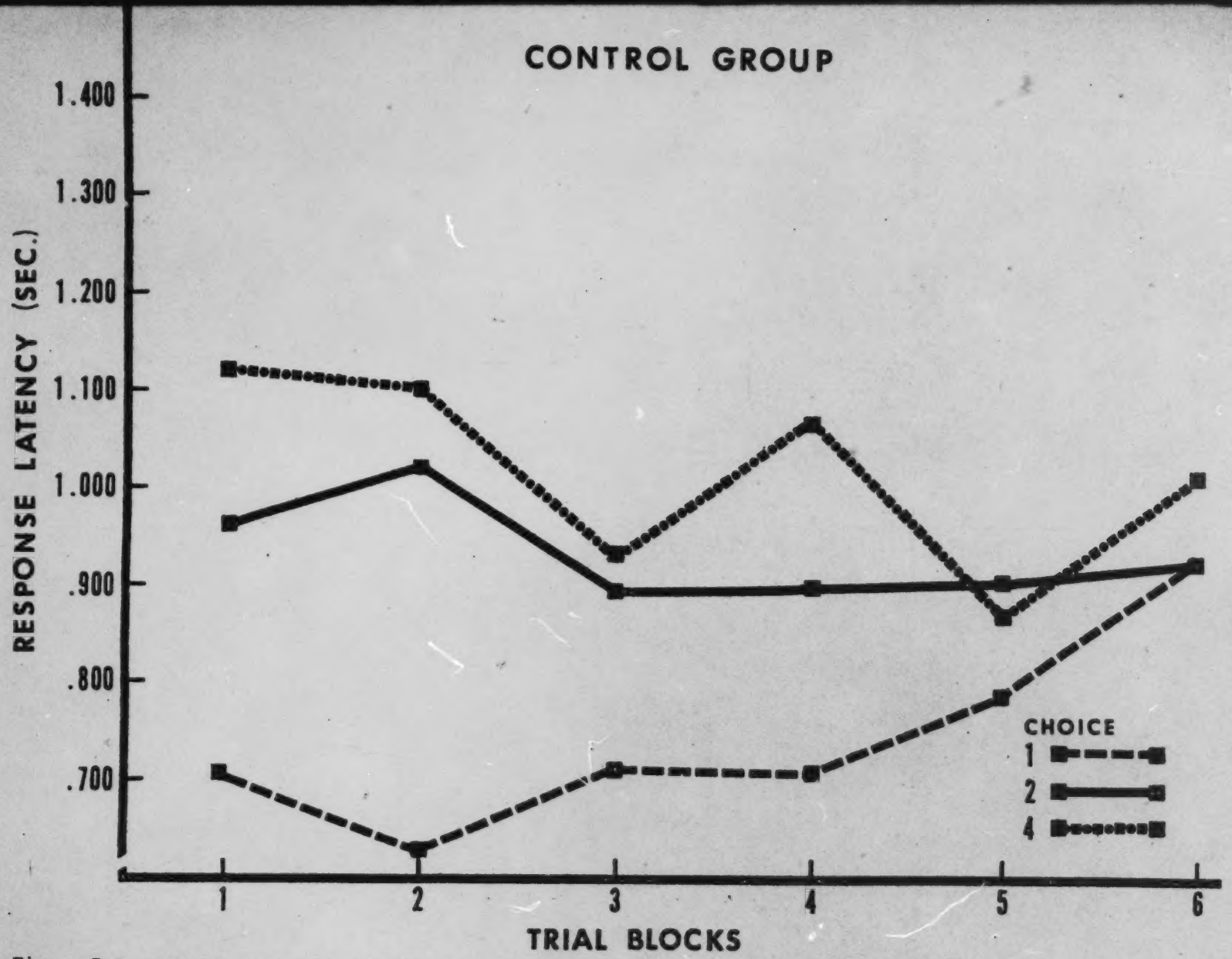

Figure 7.2 Mean RT Latency Across Trial Blocks by Choice Condition for the Control Subjects at Baseline

Table 7.0 Means and Standard Deviations of RT Latencies (Sec) for the School-Age Hyperactive Group for the Experimental and Control Diet: Treatment by Choice Condition

DIET		RT CHOICE CONDITION[1]		
		1	2	4
EXPERIMENTAL	$\bar{X}$	1.023	1.192	1.342
	SD	.64	.61	.62
CONTROL	$\bar{X}$	1.003	1.329	1.532
	SD	.55	.63	.69

[1]Choice, $p < .001$

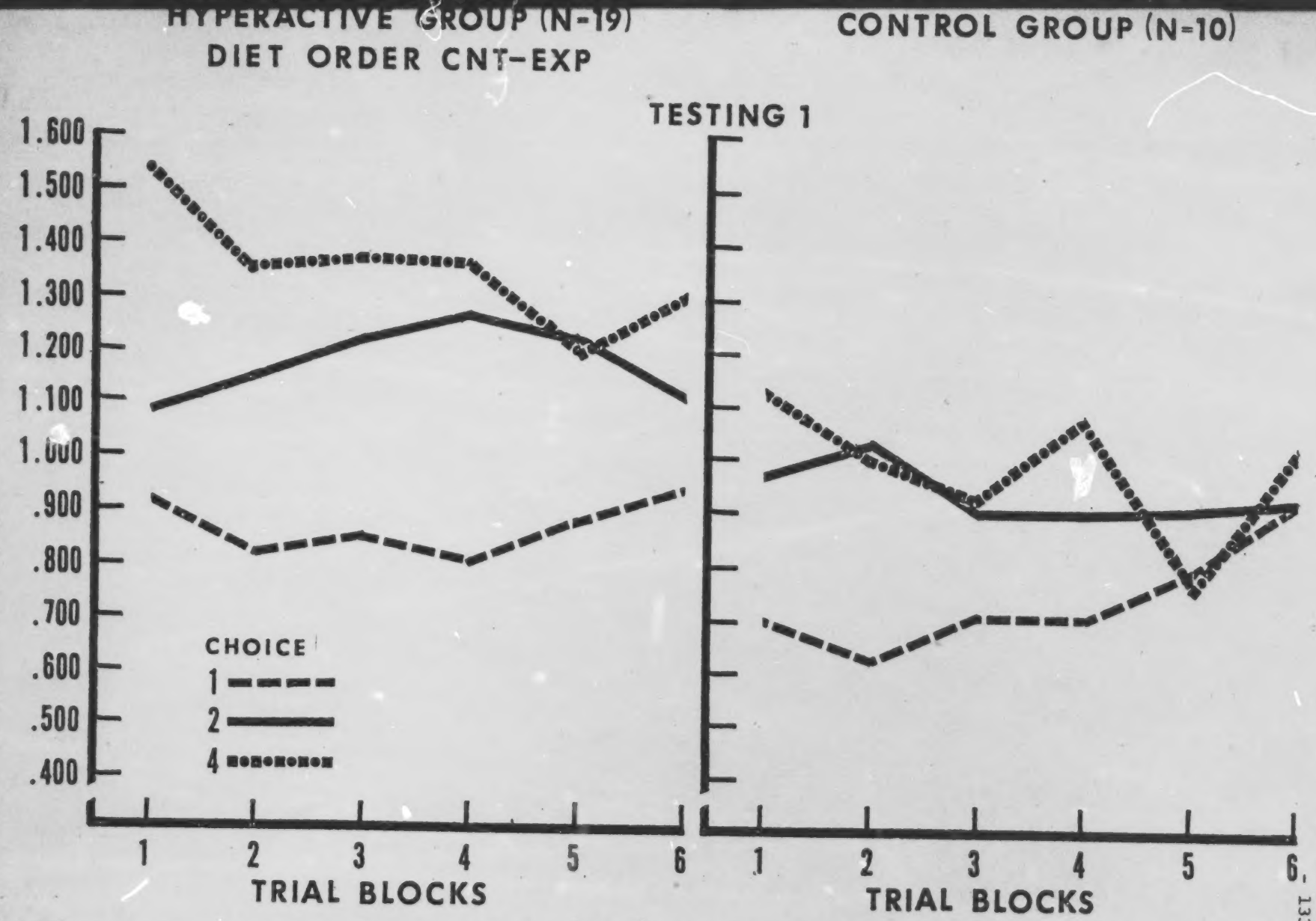

Figure 7.3 Mean RT Latency Across Trial Blocks by the Choice Conditions for the Control-Experimental Diet Order Group and the Control Subjects for the First Evaluation

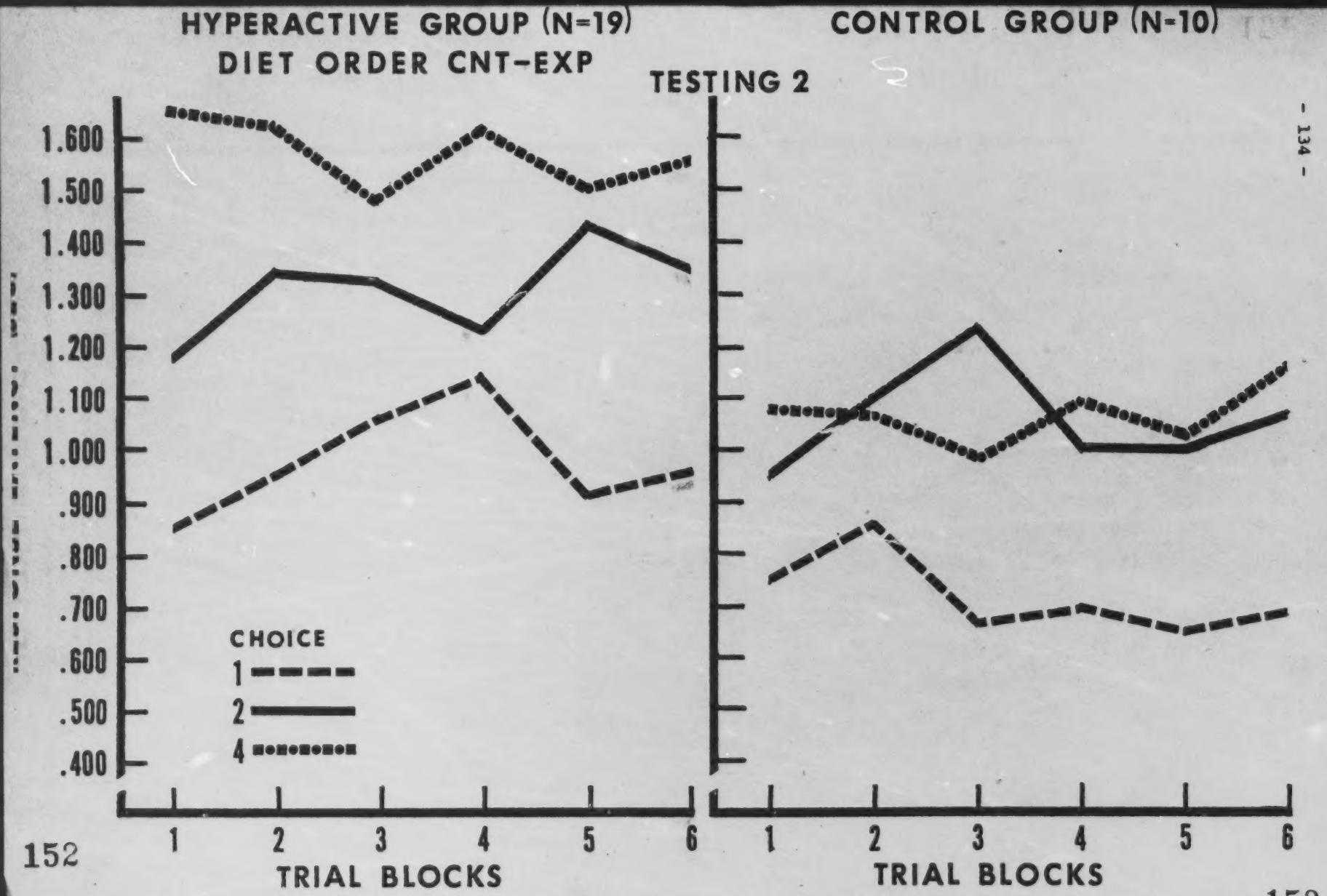

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Figure 7.4 Mean RT Latency Across Trial Blocks by the Choice Conditions for the Control-Experimental Diet Order Group and the Control Subjects for the Second Evaluation

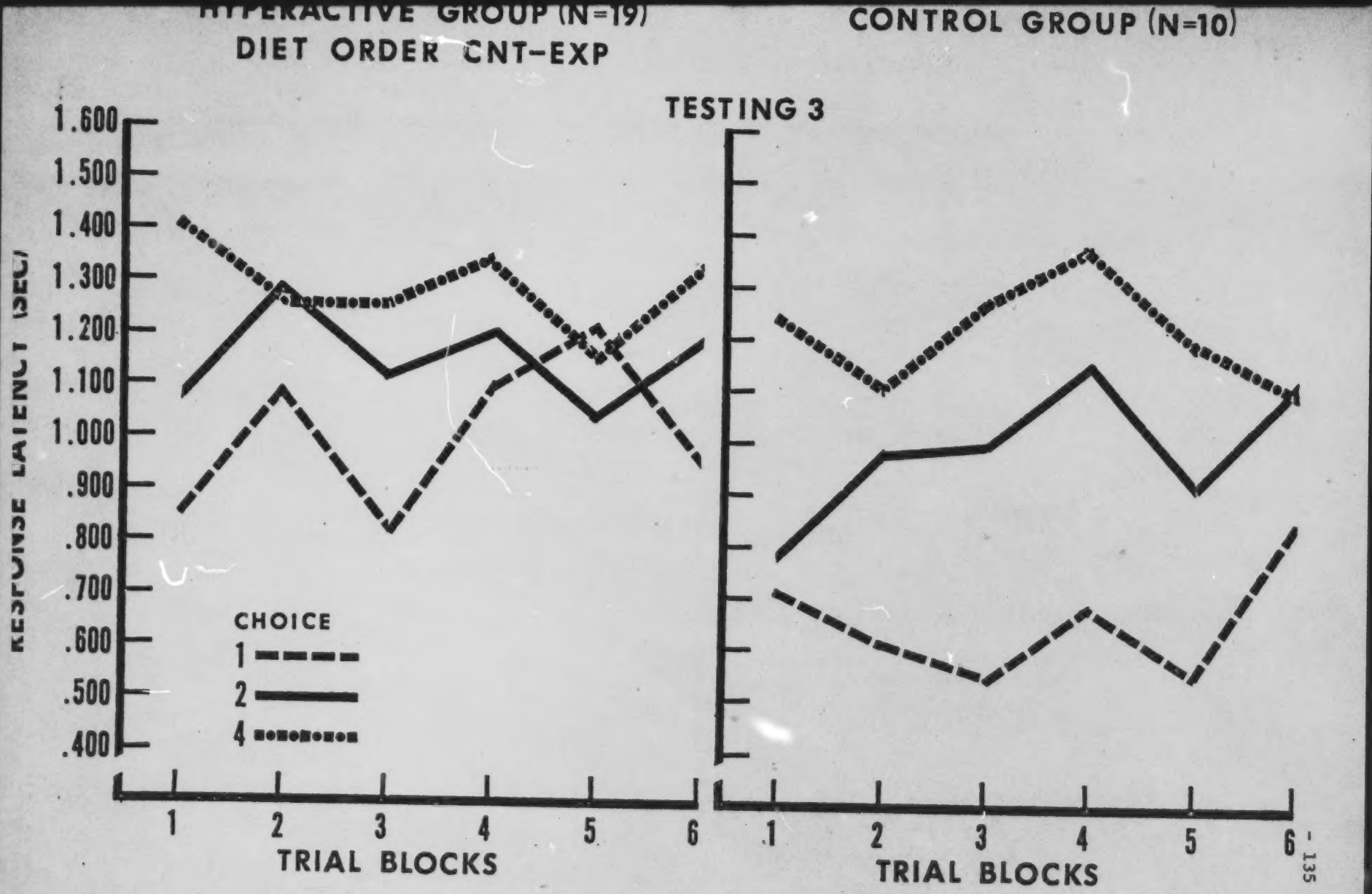
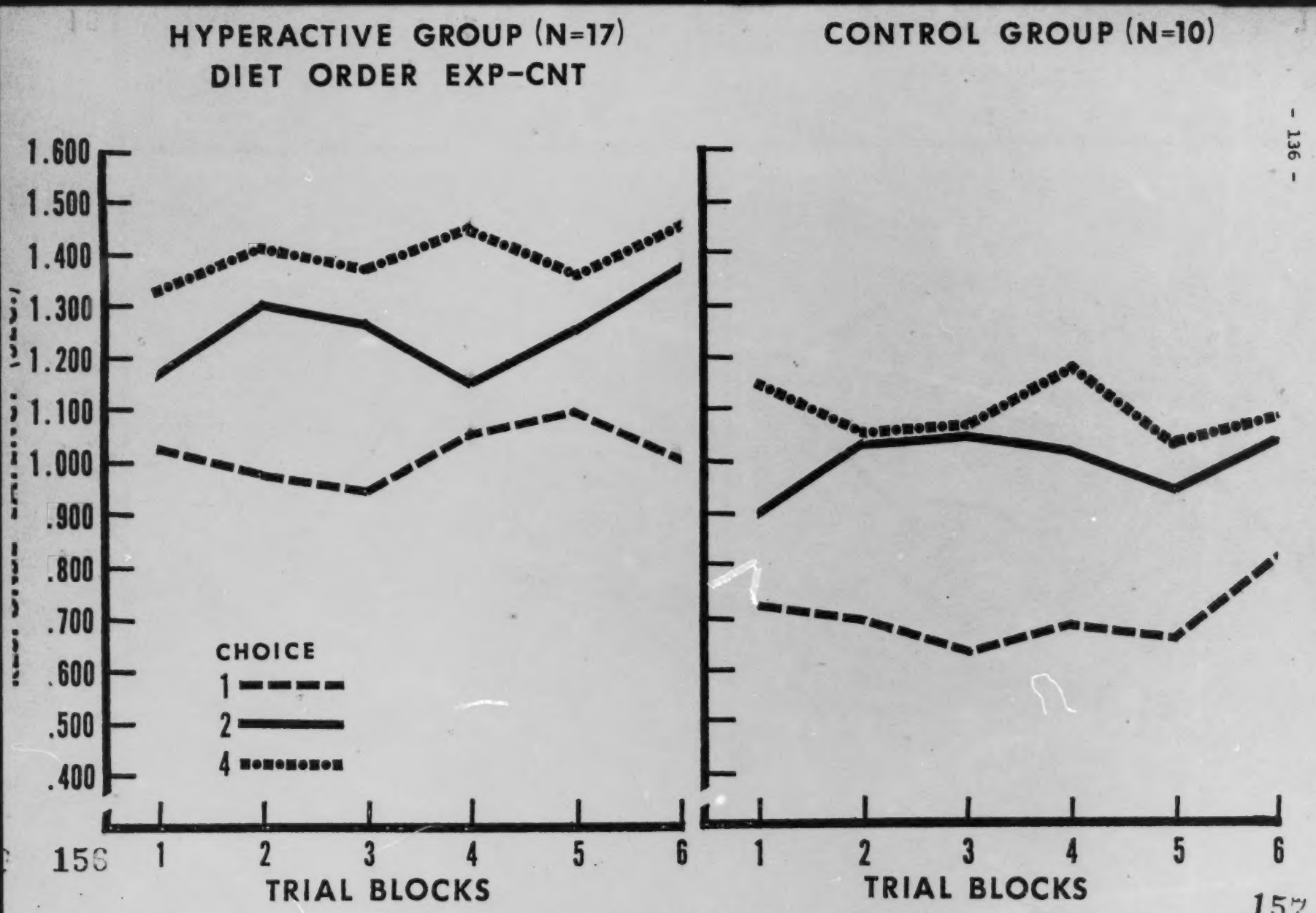


Figure 7.5 Mean RT Latency Across Trial Blocks by the Choice Conditions for the Control-Experimental Diet Order Group and the Control Subjects for the Third Evaulation



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157

Figure 7.6 Mean RT Latency Across Trial Blocks by the Choice Condition for the Experimental-Control Diet Order Group and the Control Subjects

Table 7.1 Number and Percentage of Failures to Respond Within the Three Second Response Interval for Each RT Choice Condition[1]

		BASELINE			EXP. DIET			CONTROL DIET		
		Choice			Choice			Choice		
		1	2	4	1	2	4	1	2	4
EXPERIMENTAL (N=36)	FREQ.	14	19	22	29	30	37	18	36	62
	%	2.4	3.3	3.8	5.0	5.2	6.4	3.1	6.3	10.8
		TEST 1			TEST 2			TEST 3		
CONTROL (N=10)	FREQ.	2	2	1	0	4	2	2	2	6
	%	1.3	1.3	0.6	20.0	2.5	1.3	1.3	1.3	3.8

[1]Maximum number of possible responses for each choice condition:

EXP GROUP = 576

CNT GROUP = 160

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SECTION VIII - Continuous Performance Test (CPT)

8.1 Introduction

Concentration/attentional deficits have been emphasized in hyperactive children by Douglas and her associates (1969; 1972; 1974). The coding subtest of the Wechsler Intelligence Scale for Children has been used as a measure of attention/vigilance (Douglas, Weiss and Minde, 1969), but is has been observed that Ss may compensate for momentary lapses in attention and thereby produce unimpaired test performances (Rosvold, et al., 1956). The Continuous Performance Test (CPT) was designed to eliminate possible response compensation, requiring Ss continual attention for a sustained period of time to a series of rapidly presented stimuli. This test has been used with groups with attention impairments, e.g., mentally retarded (Crosby, 1972) and epileptic patients (Mirsky and Van Buren, 1965; Mirsky and Rosvold, 1963) in addition to investigations of attention in the hyperactive child described below. A response is required whenever the specified alphabetic letter appears on a screen in front of the S. The alphabetic stimuli appear at a fast, fixed rate with a brief exposure. Lapses in attention result in either missing significant stimuli (omission errors) or incorrectly responding to nonsignificant stimuli (commission errors).

Sykes, Douglas, Weiss and Minde (1971) found that hyperactive Ss were less accurate than control Ss in detecting significant stimuli on the CPT task. At the slow interstimulus interval (1.0 vs 1.5 sec.) the hyperactive group made a greater number of responses (errors of commission) than the control Ss to the nonsignificant stimuli. The hyperactive children also were more restless (stabilimetric cushion

activity score) than the matched control group. Significant improvement (detected more significant stimuli and fewer responses to nonsignificant stimuli) was found for the hyperactive Ss given methylphenidate compared to those administered a placebo. Inattentiveness and impulsive responses were also found to be diminished in a subsequent study employing both auditory and visual CPT procedures and reaction time tasks for children receiving methylphenidate (Sykes, Douglas and Morgenstern, 1972).

The studies reviewed above indicate that hyperactive Ss perform more poorly than control Ss on the experimenter paced [redacted] quiring sustained attention, and that these defici[redacted]s can be significantly improved with the use of methylphenidate medication.

8.2 Procedure

The CPT trials were administered immediately following the RT procedures. A series of letters were presented on a 18x22 in. screen located three feet directly in front of the S. A button press (the center button, see Figure 7.0) to every occurrence of a specified letter was requested. Single alphabetic stimuli were presented in a random sequence and S was instructed to respond only to the letter X (X-series). In the AX series S was required to respond when the letter X appeared but only when it was preceded by the letter A. In all cases, stimulus duration was 0.2 sec. and the intertrial interval was 1.6 sec. Stimulus events were controlled by an Automated Data Systems 1800A computer. Each trial consisted of 140 consecutive letters containing 35 significant stimuli. A total of 2 X-series trials, followed by 2 AX-series trials were administered to each S at the end of the baseline period and at the conclusion of each of the two diets.

8.3 Results

8.31 Dependent Variables

The four dependent measures of accuracy and errors for the X- and AX series were:

Accuracy

Absolute (ABS) = (Correct Responses/Total Number of Significant Stimuli Presented) x 100

Relative (REL) = (Correct Responses/Total Responses) x 100

Errors

Commission (ERR) = Responses to Nonsignificant Stimuli

Omission (OMIT) = Failure to Respond to Significant Stimuli

8.32 Hyperactive Versus Control Ss - Baseline

The performance of the hyperactive versus the school-age controls at baseline is summarized in Table 8.0. The hyperactive Ss generally performed more poorly on the X and AX-series, but none of the group comparisons were significant $p > .05$.

8.33 Control Versus Experimental Diet

A series of 2x2 ANOVAs (Diet x Diet Order) were utilized to analyze the X and AX-series CPT dependent variables. Significant interactions of Diet x Diet Order were found for REL [F (1,34)= 4.14, $p < .05$] of the X-series. Better performance for hyperactive Ss maintained on the control diet as compared to the experimental diet was found on the AX-series as measured by the REL dependent variable [F (1,34)=5.19, $p < .05$].

The means and standard deviations for the X and AX-series for the experimental and control diets are shown in Table 8.1.

No significant main effect of Diet was obtained for the four dependent variables of the X-series. However, significant Diet x Diet Order interactions were obtained for the X-series variables REL [F (1,34)=4.14, $p < .05$] and ERR [F (1,34)=5.17, $p < .05$]. On the control diet the hyperactive Ss obtained significantly better REL AX-series scores than when evaluated on the experimental diet, [F (1,34)=5.19, $p < .05$].

8.34 Hyperactive Versus Control Ss - Testings

The 17 hyperactive Ss in the diet order group, experimental then control diet (EXP-CNT), were compared to the control, non-hyperactive group (N=10) across the three separate testings. Separate two-way ANOVAs with repeated measures were used to compare the two groups on the four dependent variables (Winer, 1962). No significant main effects or interactions were obtained. Table 8.2 presents the four CPT dependent variables for the X and AX-series for the hyperactive (EXP-CNT Diet Sequence) and the control groups.

The same analyses were conducted for the experimental group receiving the diet sequence, control-experimental diet. A main effect of testing was found for the dependent variables ABS and ERR of the X-series and ABS and OMIT of the AX-series. The means for these hyperactive and control Ss for the CPT variables are given in Table 8.3.

Table 8.0 Continuous Performance Test Scores for Hyperactive and Control School-Age Subjects at Baseline

		X-SERIES				AX-SERIES			
		ABS[1]	REL[2]	ERR[3]	OMIT[4]	ABS	REL	ERR	OMIT
HYPERACTIVE	$\bar{X}$	94.46	85.33	12.61	3.88	84.37	82.52	14.00	10.94
GROUP	SD	7.70	12.43	12.56	5.39	10.35	14.27	12.98	7.25
CONTROL	$\bar{X}$	95.43	86.23	12.30	3.20	89.29	85.46	13.30	7.50
GROUP	SD	7.64	13.43	14.21	5.35	5.84	14.95	15.68	4.09

[1]ABS = (Correct Responses/70) x 100

[2]REL = (Correct Responses/Total Responses) x 100

[3]ERR = Responses to Nonsignificant Stimuli

[4]OMIT = Failure to Respond to Significant Stimuli

Table 8.2 Means and Standard Deviations of the Continuous Performance Test Dependent Variables for the Hyperactive Subjects Receiving the Experimental/Control Diet Sequence and the Control Group.

	TESTING		X-SERIES ABS	X-SERIES REL	X-SERIES ERR	X-SERIES OMIT	AX-SERIES ABS	AX-SERIES REL	AX-SERIES ERR	AX-SERIES OMIT
EXPERIMENTAL GROUP (N=17)	1 (Baseline)	$\bar{X}$	94.54	85.88	11.82	3.82	85.38	84.32	12.06	10.24
		SD	7.20	10.49	11.09	5.04	10.53	11.10	9.84	7.37
	2 (EXP Diet)	$\bar{X}$	93.95	84.86	12.65	4.24	85.38	76.81	19.53	10.24
		SD	7.55	11.92	10.87	5.29	12.83	15.97	14.50	8.98
	3 (CNT Diet)	$\bar{X}$	90.34	88.52	8.47	6.77	86.22	81.18	14.82	9.65
		SD	9.84	9.99	7.85	6.89	8.95	11.92	10.70	6.26
CONTROL GROUP (N=10)	1 (Baseline)	$\bar{X}$	94.43	86.23	12.30	3.20	89.29	85.46	13.30	7.50
		SD	7.64	13.43	14.21	5.35	5.84	14.95	15.68	4.09
	2 (Testing 2)	$\bar{X}$	98.43	89.70	9.80	1.10	91.71	85.19	12.00	5.80
		SD	2.38	13.73	14.33	1.16	6.49	11.83	10.30	4.54
	3 (Testing 3)	$\bar{X}$	95.14	91.92	6.40	3.40	90.29	89.14	8.20	6.80
		SD	5.68	9.53	8.10	3.98	6.49	8.96	7.67	4.54

Table 8.3 Means and Standard Deviations of the Continuous Performance Test Dependent Variables for the Hyperactive Subjects Receiving the Control/Experimental Diet Sequence and the Control Group.

			X-SERIES				AX-SERIES			
	TESTING		ABS[1]	REL	ERR[1]	OMIT	ABS[1]	REL	ERR	OMIT[1]
EXPERIMENTAL GROUP (N=19)	1 (Baseline)	$\bar{X}$	94.36	84.62	13.32	3.95	83.38	80.52	15.84	11.63
		SD	7.70	13.49	13.05	5.39	9.50	15.71	14.38	6.65
	2 (CNT Diet)	$\bar{X}$	86.62	85.85	10.11	9.37	90.38	83.76	13.26	6.74
		SD	18.57	14.61	10.79	13.00	8.08	12.65	11.18	5.66
	3 (EXP Diet)	$\bar{X}$	88.72	88.97	7.68	7.89	85.26	81.03	14.47	10.32
		SD	16.05	10.63	7.99	11.23	16.08	14.34	11.96	11.25
CONTROL GROUP (N=10)	1 (Baseline)	$\bar{X}$	94.43	86.23	12.30	3.20	89.29	85.46	13.30	7.50
		SD	7.64	13.43	14.21	5.35	5.84	14.95	15.68	4.09
	2 (Testing 2)	$\bar{X}$	98.43	89.70	9.80	1.10	91.71	85.19	12.00	5.80
		SD	2.38	13.73	14.33	1.16	6.49	11.83	10.30	4.54
	3 (Testing 3)	$\bar{X}$	95.14	91.92	6.40	3.40	90.29	89.14	8.20	6.80
		SD	5.68	9.53	8.10	3.98	6.49	8.96	7.67	4.54

[1]Testing effect $p < .05$

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SECTION IX - Neuropsychological Tests

9.1 Procedure

The battery of neuropsychological tests described below was administered at the end of baseline and following each diet condition for the 36 hyperactive school-age sample. A group of 10 non-hyperactive control children was administered the same battery of tests on the same three test occasions.

9.2 Rationale for Selection of Neuropsychological Variables

A battery of tests was developed by Halstead (1947) for the comprehensive examination of brain damaged adult patients. This neuropsychological test battery has been extended downward for use with children (Reitan, 1969). A supplementary battery of motor proficiency measures (Wisconsin Motor Steadiness Battery) developed by Matthews and Kløve (1964) provided additional dependent variables in the present study. The use of neuropsychological tests in evaluating children with cerebral dysfunction, including hyperactivity, has been described by several investigators (Benton, 1974; Boll, 1974; Reed, 1971; Reitan, 1974). The tests employed in this study were selected for their demonstrated potential in discriminating hyperactive and control children and/or showing improvement following treatment with psychotropic medication (Knights, 1974). Each of the tests is separately described below.

9.3 Wechsler Intelligence Scale for Children (WISC)

The Digit Span and coding subtests of the WISC were administered (Wechsler, 1949). Digit Span: orally presented lists of 3 to 9 digits to be repeated orally. In a second series S must orally reproduce lists of 2 to 8 digits backwards. The test is conventionally viewed as a

measure of immediate attention and concentration. Conners (1972), reported significant improvement on the Digit Span subtest of the WISC following treatment with stimulant medication. Coding: a code-substitution test in which symbols (or figures depending on S's age) must be paired with digits. This score is the number of correct responses made in 120 sec. Good test performance is dependent upon rapid eye-hand coordination and visual perceptual learning.

9.4 Wide Range Achievement Test (WRAT)

The WRAT consists of three parts: reading (word recognition), spelling, and arithmetic. Grade equivalent scores are obtained from S's performances (Jastak and Jastak, 1965).

9.5 Finger Tapping Speed

The mean of five 10 sec. trials is obtained for the index finger of each hand, starting with S's preferred hand, using a mechanical (electric tapping device for Ss younger than nine years) counter device (Reitan, 1969). Finger tapping, a measure of motor speed and coordination, was found to improve in a double-blind, crossover study of methylphenidate and placebo (Millichap, et al., 1968).

9.6 Maze or Kinetic Steadiness Test

S is required to trace a maze with a stylus using his preferred and then his nonpreferred hand. Number of contacts (errors) and cumulative contact time are electrically recorded (Matthews and Kløve, 1964).

9.7 Grooved Pegboard Test

This is a measure of manual dexterity which requires S to place grooved pegs into randomly positioned slots. The 4 in. square pegboard

contains 25 holes and S places the pegs into the holes in a fixed order. One trial is given with each hand, beginning with S's preferred hand. The time required to complete the task with each hand is recorded (Matthews and Kløve, 1964).

9.8 Static Steadiness Test

S is required to hold a metal stylus in a series of progressively smaller holes. The stylus must be held steady, without touching the sides of the hole for 15 sec. S is not allowed to rest or brace his arm. Cumulative contact time and number of contacts (errors) are electrically recorded for each hand (Matthews and Kløve, 1964).

Knights and Hinton (1969) found that 40 hyperactive children performed better on the maze and static steadiness tests after being placed on methylphenidate for six weeks, but no similar improvement was observed on the pegboard test.

9.9 Knox Cube Test

A test of immediate visual memory. Four identical wooden cubes arranged in a row are tapped in a predetermined sequence by the examiner. S is then required to imitate the sequence. The procedure is repeated with successive series of taps of increasing length and complexity (Arthur, 1947). The test is given at the beginning of the test session and is then readministered at the conclusion of the testing.

9.10 Porteus Maze

A series of paper-pencil mazes graded in difficulty. Two scores are derived from this test: a test quotient (TQ) and a qualitative (Q) score, TQ is a measure of planning, judgment and foresight; Q is a measure of motor-impulse control, e.g. wavy lines, cutting corners, etc. (Porteus, 1965).

The Porteus Maze test requires both motor coordination and attention for successful completion. A number of investigations have shown that improvement is obtained when stimulant medication is administered to hyperactive or learning disabled children (Conners, Eisenberg and Sharp, 1964; Conners and Rothchild, 1968). Positive effects were demonstrated for the TQ dependent variable, which is usually considered a measure of planning-judgment and attention. The Q scores, reflecting basic motor control, were not affected by medication. Knights and Hinton (1969) conclude that "this finding suggests that the stimulant affected attention abilities more than motor control skills" (p. 651).

Behavioral techniques have been found to be effective in modifying poor attention and impulsivity in hyperactive Ss. Ten hyperactive children trained in the use of self-control of voluntary behavior showed significant improvement on the Porteus Maze test for both the TQ and Q scores when compared with 10 hyperactive control Ss (Palkes, Stewart and Kahana, 1968).

9.11 Cognitive Style

Cognitive styles and their relationship to hyperactivity have been investigated. Cognitive style is defined as "characteristic, self-consistent modes of functioning which individuals show in their perceptual and intellectual activities." (Witkin, Ottman, Raskin and Karp, 1971, p.3). The validity and applicability of this construct has not been agreed upon, and continues to be controversial (Block, Block and Harrington, 1974; Weisz, O'Neill and O'Neill, 1975; Kagan, 1965; Kagan and Messer, 1975). The primary cognitive styles which have been studied include: reflection-impulsivity and field independence-dependence. The

former cognitive style ranges from the reflective child who is able to inhibit motor responses and to carefully consider the alternatives before making a decision or response to the impulsive child who responds almost immediately, without "thinking". The other major cognitive style includes the field independent child who is able to separate or isolate a figure from a distracting background, and the field dependent child who is unable to separate the figure from the ground and experiences all the parts of the field as fused or undifferentiated. Inefficient cognitive styles (impulsive and field dependent) may directly and substantially contribute to the classroom difficulties of the hyperactive child (Campbell, 1973; Douglas, 1972; Campbell, Douglas and Morgenstern, 1971). Measures used in the present study to assess these two major categories of cognitive style are described in 9.12 (reflectiveness-impulsivity) and 9.13 (field independence) below.

9.12 Matching Familiar Figures (MFF)

S is shown a picture and must identify an identical picture from a set of six other stimuli. The standard and other highly similar pictures were always available to S for inspection. Mean latency of the first selection and number of errors was recorded for the 12 test items. The test provides a measure of reflection versus impulsivity in cognitive style (Kagan, 1965).

9.13 Children's Embedded Figures Test (CEFT)

This test requires S to locate a simple geometric form embedded in a more complex design (Karp and Konstadt, 1963). In the first series of 11 designs S has to identify a hidden test (triangle). A house shape has to be located in the second set of 14 items. The number of correct

responses is scored for each series as is the total score. The test provides a measure of field independent-dependent cognitive style.

9.14 Psychological Examination Behavior Profile (PEBP)

At the conclusion of each of the three neuropsychological evaluations, the examiner rated S's behavior on the 15 item PEBP Scale (Appendix IX). Ratings of 2 on the five-point scale represent "normal" behavior. Lower values indicate less arousal/activity or interaction with the examiner and higher scores reflect greater interaction. Therefore, a total score of 30 for the 15 items would be indicative of appropriate/expected behavior.

9.15 Results

9.151 Neuropsychological Variables

The 36 hyperactive Ss were compared to the 10 nonhyperactive controls at baseline on 16 neuropsychological measures (Table 9.0). Significantly better scores were earned by the controls on the WISC coding subtest, static steadiness for the dominant hand and the Knox Cubes Test. The MFF (Table 9.1) and CEFT Test (Table 9.2) failed to significantly differentiate the hyperactive and control group on the initial (baseline) examination.

The neuropsychological variables were analyzed, using the same model as for the previously reported dependent variables, by 2x2 ANOVAs (Table 9.3). A significantly better score on the WISC coding subtest was obtained when Ss were on the control ($\bar{X}$=12.08; SD=2.80) as compared to the experimental diet ($\bar{X}$=11.28; SD=2.20), F (1,34)=5.25, $p < .05$. Word recognition (WRAT-reading) was found to be higher also for the control ($\bar{X}$=5.12; SD=2.70) than for the

experimental ($\bar{X}$=4.94; SD=2.60) diet, F (1,34)=4.43, $p < .05$. The single motor measure of finger tapping speed for the nondominant hand showed a significant [F (1,34)=7.45, $p < .01$] main diet effect, with better performances obtained for the control diet condition. The Diet by Diet Order interaction was significant for dominant hand finger tapping speed, F (1,34)=5.22, $p < .05$. Performance on the static steadiness test was better in the experimental diet condition for the dominant (F (1,34)=6.47, $p < .05$) and the nondominant (F (1,34)=4.92, $p < .05$) hand trials. The TQ scores of the Porteus Maze Test were significantly higher for the control ($\bar{X}$=126.30; SD=9.97) versus the experimental diet ($\bar{X}$=121.30; SD=12.67), F (1,34)= 8.41, $p < .01$. Better performance was obtained for the control diet condition for the Tent series of the CEFT. In summary, the analyses summarized in Table 9.3 reveal significant main effect of diet for six dependent variables. In all cases except for static steadiness, the better scores were found for the control diet period, and not for the experimental diet condition.

Since the CEFT yielded significant Diet x Diet Order interactions (Table 9.3) the means and standard deviations are shown for the tent, house and total variables of the CEFT in Table 9.4.

Analyses of the experimental-control diet order group (Table 9.5) and the control-experimental diet sequence (Table 9.6) yielded significant differences between the hyperactive groups and the control sample for the WISC coding subtest, static steadiness and Knox Cubes test. Evidence of a practice effect of the three examinations is indicated by the significant main effect of testing (Tables 9.5 and 9.6).

9.152 Psychological Exam Behavior Profile (PEBP)

The PEBP was completed at the conclusion of the three neuropsychological testings for each of the experimental and control Ss (Appendix IX). The 36 experimental and 10 nonhyperactive controls were compared at baseline on the PEBP variables (Table 9.7).

The hyperactive Ss were found to be generally more dependent (Item 8) than the controls (t=1.98, df=44, $p < .05$), and were also judged by the examiner to display signficiantly shorter attention spans (Item 9) than the control Ss, t=2.08, df=44, $p < .05$.

Table 9.0: Results of t Tests for the Neuropsychological Variables: School-Age Hyperactive versus Control Subjects at Baseline

VARIABLE		HYPERACTIVE (N=36)	CONTROL (N=10)	t	p
WISC					
Digit Span	$\bar{X}$	9.36	10.40	1.25	NS
	SD	2.33	2.32		
Coding	$\bar{X}$	9.67	12.30	2.54	<.01
	SD	2.94	2.75		
WRAT					
Reading	$\bar{X}$	4.48	5.23	.85	NS
	SD	2.46	2.53		
Spelling	$\bar{X}$	3.39	3.68	.41	NS
	SD	2.01	1.74		
Arithmetic	$\bar{X}$	3.11	3.25	.33	NS
	SD	1.21	1.34		
FINGER TAPPING					
Dominant Hand	$\bar{X}$	33.39	34.10	.34	NS
	SD	5.49	7.28		
Nondominant Hand	$\bar{X}$	30.42	33.10	1.33	NS
	SD	4.61	8.57		
MAZE					
Dominant Hand-Errors	$\bar{X}$	1.76	1.13	.96	NS
	SD	1.81	1.90		
Nondominant Hand-Errors	$\bar{X}$	3.26	2.59	.54	NS
	SD	3.19	4.49		
PEGBOARD					
Dominant Hand	$\bar{X}$	80.56	82.50	.23	NS
	SD	24.79	19.78		
Nondominant Hand	$\bar{X}$	86.44	84.50	.24	NS
	SD	23.96	20.91		
STATIC STEADINESS					
Dominant Hand-Errors	$\bar{X}$	45.00	22.80	2.09	<.05
	SD	31.77	19.44		
Nondominant Hand-Errors	$\bar{X}$	62.94	39.10	1.82	NS
	SD	38.77	26.96		
KNOX CUBES	$\bar{X}$	9.88	12.05	2.15	<.05
	SD	2.98	2.09		
PORTEUS MAZE					
Qualitative Score	$\bar{X}$	48.33	43.80	.43	NS
	SD	30.25	24.63		
Test Quotient	$\bar{X}$	120.50	122.50	.39	NS
	SD	13.80	14.69		

Table 9.1 Hyperactive versus Control School-Age Subjects at Baseline for the Matching Familiar Figures Test

VARIABLE		HYPERACTIVE (N=10)	CONTROL (N=10)	t	p
RESPONSE LATENCY (SEC)	$\bar{X}$	10.52	13.69	1.99	NS
	SD	3.52	3.63		
RESPONSES/TRIAL	$\bar{X}$	2.07	1.78	1.21	NS
	SD	.64	.42		
TOTAL ERRORS	$\bar{X}$	12.80	9.30	1.21	NS
	SD	7.67	5.06		

Table 9.2 Correct Responses for the Childrens Embedded Figures Test for the Hyperactive versus Control School-Age Subjects at Baseline

VARIABLE		HYPERACTIVE (N=10)	CONTROL (N=10)	t	p
TENT	$\bar{X}$	7.00	7.20	.16	NS
	SD	2.87	2.57		
HOUSE	$\bar{X}$	4.60	3.66	.45	NS
	SD	3.80	4.21		
TOTAL	$\bar{X}$	11.60	11.00	.22	NS
	SD	5.80	6.52		

Table 9.3 Results of ANOVAs for Neuropsychological Tests for the School-Age Hyperactive Subjects for the Experimental and Control Diet Conditions

VARIABLE	MAIN EFFECTS		INTERACTION
	Diet	Diet Order	Diet x Diet Order
WISC			
Digit Span	NS	NS	NS
Coding	<.05	NS	NS
WRAT			
Reading	<.05	NS	NS
Spelling	NS	NS	NS
Arithmetic	NS	NS	NS
FINGER TAPPING			
Dominant Hand	NS	NS	<.05
Nondominant Hand	<.01	NS	NS
MAZE			
Dominant Hand	NS	NS	NS
Nondominant Hand	NS	NS	NS
PEGBOARD			
Dominant Hand	NS	NS	NS
Nondominant Hand	NS	NS	NS
STATIC STEADINESS			
Dominant Hand	<.05	NS	NS
Nondominant Hand	<.05	NS	NS
KNOX CUBES	NS	NS	NS
PORTEUS MAZE			
Qualitative Score	NS	NS	NS
Test Quotient	<.01	NS	NS
MFF			
Response Latency	NS	NS	NS
Errors	NS	NS	NS
CEFT			
Tent	<.05	NS	<.001
House	NS	NS	<.001
Total	NS	NS	<.001

Table 9.4 Summary of ANOVAs for Correct Responses on the Childrens Embedded Figure Test by Diet Order for the School-Age Hyperactive Subjects

VARIABLE	DIET		DIET ORDER: EXPERIMENTAL/CONTROL (N=17)	DIET ORDER: CONTROL/EXPERIMENTAL (N=19)
Tent[1,2]	EXP	$\bar{X}$	7.82	8.42
		SD	2.30	2.19
	CNT	$\bar{X}$	9.53	8.00
		SD	1.77	2.56
House[2]	EXP	$\bar{X}$	6.94	6.53
		SD	4.15	4.66
	CNT	$\bar{X}$	7.77	4.79
		SD	4.56	4.33
Total[2]	EXP	$\bar{X}$	14.76	14.95
		SD	6.05	6.61
	CNT	$\bar{X}$	17.29	12.79
		SD	6.09	6.37

[1]Diet < .05

[2]Diet Order x Diet $p < .001$

Table 9.5 Results of ANOVAs on the Neuropsychological Tests for the School-Age Hyperactive Children Receiving the Experimental-Control Diet Sequence and Control Subjects for the Three Testings

VARIABLE	MAIN EFFECT		INTERACTION
	Group	Testing	Group x Testing
WISC			
Digit Span	NS	NS	NS
Coding	<.06	<.001	NS
WRAT			
Reading	NS	<.001	<.002
Spelling	NS	<.005	NS
Arithmetic	NS	NS	NS
FINGER TAPPING			
Dominant Hand	NS	<.001	NS
Nondominant Hand	NS	NS	NS
MAZE			
Dominant Hand	NS	<.05	NS
Nondominant Hand	NS	NS	NS
PEGBOARD			
Dominant Hand	NS	<.001	NS
Nondominant Hand	NS	<.01	NS
STATIC STEADINESS			
Dominant Hand - Errors	<.05	<.05	NS
Nondominant Hand - Errors	NS	NS	NS
KNOX CUBES	<.05	NS	NS
PORTEUS MAZE			
Qualitative Score	NS	<.01	NS
Test Quotient	NS	<.05	NS

Table 9.6 Results of ANOVAs on the Neuropsychological Tests for the School-Age Hyperactive Children Receiving the Control-Experimental Diet Sequence and Control Subjects for the Three Testings

VARIABLE	MAIN EFFECT		INTERACTION
	Group	Testing	Group x Testing
WISC			
Digit Span	NS	NS	NS
Coding	<.02	<.001	NS
WRAT			
Reading	NS	<.01	<.05
Spelling	NS	<.001	NS
Arithmetic	NS	NS	NS
FINGER TAPPING			
Dominant Hand	NS	NS	NS
Nondominant Hand	NS	NS	NS
MAZE			
Dominant	NS	NS	NS
Nondominant	NS	NS	NS
PEGBOARD			
Dominant Hand	NS	<.001	NS
Nondominant Hand	NS	<.002	NS
STATIC STEADINESS			
Dominant Hand - Errors	NS	NS	NS
Nondominant Hand - Errors	NS	NS	NS
KNOX CUBES	<.05	NS	NS
PORTEUS MAZE			
Qualitative Score	NS	<.01	NS
Test Quotient	NS	<.01	NS

Table 9.7 Means, Standard Deviations and t-Tests for the Hyperactive versus Control School-Age Subjects at Baseline for the PEBP Variables

VARIABLES		SUBJECTS EXPERIMENTAL (N=36)	CONTROL (N=10)	t	p
Separation from Mother	$\bar{X}$	.86	1.00	.47	NS
	SD	.87	.67		
Fearfulness	$\bar{X}$	1.31	1.20	.39	NS
	SD	.75	.79		
Rapport with Examiner	$\bar{X}$	2.25	2.20	.16	NS
	SD	.81	1.03		
Self-confidence	$\bar{X}$	1.89	2.30	1.14	NS
	SD	.82	.82		
Emotional Reactivity	$\bar{X}$	1.81	1.80	.03	NS
	SD	.58	.42		
Degree of Cooperation	$\bar{X}$	2.36	2.70	1.07	NS
	SD	.90	.82		
Level of Frustration Tolerance	$\bar{X}$	1.92	2.00	.36	NS
	SD	.73	.00		
Degree of Dependence	$\bar{X}$	1.92	1.30	1.98	<.05
	SD	.87	.82		
Degree of Attention Span	$\bar{X}$	1.97	2.60	2.08	<.05
	SD	.88	.70		
Goal Orientation	$\bar{X}$	2.53	2.70	.73	NS
	SD	.65	.67		
Level of Activity	$\bar{X}$	2.08	1.90	.53	NS
	SD	.97	.99		
Nature of Activity	$\bar{X}$	2.08	2.10	.10	NS
	SD	.50	.32		
Nature of Communication	$\bar{X}$	2.36	1.40	2.87	<.01
	SD	.89	1.08		
Assertiveness	$\bar{X}$	2.03	2.20	.62	NS
	SD	.74	.92		
Hostility	$\bar{X}$	2.39	2.60	.78	NS
	SD	.80	.52		
TOTAL	$\bar{X}$	29.75	30.00	.18	NS
	SD	4.14	2.26		

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APPENDIX IX

Items of the Psychological Examination Behavior Profile (PEBP)

1. Separation from Mother - The range is from "shows no concern" to "very upset".

   0 = Shows no concern; eager to leave mother and go with examiner.
   1 = Shows very little concern; shows little cautiousness and comes with examiner without preamble, needs little or no explanations.
   2 = May show some initial reticence, which is felt to be entirely appropriate; separates from mother after some minimal reassurances and explanations.
   3 = More than usual amount of concern; more disturbed than most, but finally is able to separate; may need continuing reassurances.
   4 = Very upset, cries, clings to mother, may have tantrum or withdraw, refusing to look at or talk to the examiner; mother's presence may be required in the test room.

2. Fearfulness - The range is from "no apparent awareness of strange situation" to "very fearful and apprehensive".

   0 = No apparent awareness of strange situation; completely unafraid, and behavior uninhibited.
   1 = Very little fear evidenced; quickly at ease in the situation.
   2 = Normal amount of caution in the situation but able to cope with it.
   3 = Inhibited and uneasy throughout with some slowing of responses.
   4 = Very fearful and apprehensive; acute discomfort interferes significantly with test performance.

3. Rapport with Examiner - The range is from "exceptionally shy" to "extreme friendliness".

   0 = Exceptionally shy; withdrawn; unresponsive or ignores any friendly overtures.
   1 = Shy; waits for friendly gestures; very little social interaction or social contact on his own initiative.
   2 = Perhaps some initial shyness; feels at ease; relates in a friendly manner.
   3 = Very friendly; and at ease.
   4 = Extreme friendliness; focuses on social interaction with little or no interest in test materials.

4. Self-confidence - The range is from "lacks self-confidence" to "very self-confident".

   0 = Lacks self-confidence; extremely self-critical; may refuse to attempt many tasks because they seem too difficult.
   1 = Distrusts own ability; tends to minimize his performance and often points out what is wrong.
   2 = Adequately self-confident; usually sure of himself but recognizes difficulty of certain tasks and may be a little hesitant with them.
   3 = More than usual amount of self-confidence; works easily without tensions and is usually satisfied with his performance.
   4 = Very self-confident; child extremely proud of performance and acts as if he can tackle anything.

5. Emotional Reactivity - The range is from "extremely flat" to "extreme instability of emotional responses".

   0 = Extremely flat; no change in facial expression; responds to all activities in same manner.
   1 = Somewhat flat; little change in emotional tone, some slight variations at times.
   2 = Normal responsiveness; affect appropriate to situation.
   3 = Mood more variable than average; may be motivated internally or exaggerated responsiveness to situation.
   4 = Extreme instability of emotional responses; marked emotional lability; either over-reactive to external situations or to undetermined stimuli.

6. Degree of Cooperation - The range is from "extreme negativism" to "extremely suggestible and conforming".

   0 = Extreme negativism; continually resistant to directions or demands of the situation; examiner's suggestions or directions have little obvious effect on child.
   1 = Resistive to demands or directions a good deal of the time; willing to comply only when faced with success, or requires considerable prompting to elicit response.
   2 = Cooperative with reasonable amount of discomfort and anxiety when faced with difficulty or failure, responds well to directions most of the time.
   3 = Accepts directions or demands more easily; eager to conform even when faced with failure; rarely attempts to do anything unless examiner has explicitly stated it.
   4 = Extremely suggestible and conforming; no apparent discomfort when faced with failure, completely dependent upon specific directions from examiner.

7. Level of Frustration Tolerance - The range is from "withdraws completely" to "extreme acting out behavior and/or crying".

   0 = Withdraws completely; refuses to continue or attempt any task which appears too difficult for him.
   1 = Occasionally withdraws from task where difficulty is encountered or appears too difficult for success.
   2 = Attempts to cope with difficult situations; does not become unduly upset if task is too difficult.
   3 = Becomes quite upset by difficulty; may react with some disorganized behavior; some anger may be displayed against the test materials or examiner; may resort to crying.
   4 = Extreme acting out behavior and/or crying; considerable anger displayed; behavior becomes uncontrolled and continuation of examination may become impossible or very difficult.

8. Degree of Dependence - The range is from "very self-reliant" to "constant need for attention or help".

   0 = Very self-reliant; refuses help; extreme overt confidence.
   1 = Rarely needs reassurance; primarily absorbed with test materials; little attention demanded.
   2 = Dependent in appropriate situations; enjoys attention but can function easily without it; adequately confident.
   3 = Demands more attention than average; needs frequent help, reassurance, approval and encouragement.
   4 = Constant need for attention or help; cannot function without continual approval or support

9. Duration of Attention Span - The range is from "attends to tasks very briefly" to "highly perseverative".

   0 = Attends to tasks very briefly; highly distractible, fleeting and sporadic attention; lack of concentration interferes significantly with test performance.
   1 = Spends short time with tasks; easily distractible; frequently needs help in maintaining attention; brief attention may interfere somewhat with test performance.
   2 = Spends adequate amount of time on tasks; able to concentrate until successful or until failure is clear.
   3 = Spends more than average time on tasks; eventually is able to turn to new activity.
   4 = Highly perseverative; unable to shift attention; fixated at one task; requires examiner's intervention in order to change activity.

10. Goal Orientation - The range is from "no effort to reach a goal" to "compulsive absorption with task".

   0 = No effort to reach a goal; extremely lacking in persistence or unable to keep goal or questions in mind.
   1 = Briefly attempts to achieve goal; easily forgets goal or question, or fails to persist; less than average ability to continue to completion.
   2 = Able to keep goal or directions in mind; able to persist until completion; able to "give up" when appropriate.
   3 = Keeps goal and questions in mind; persists for more than usual amount of time; continues effort beyond necessary point.
   4 = Compulsive absorption with task; unwilling or unable to "give up"; resists or ignores examiner's attempts to change activity.

11. Level of Activity - The range is from "extreme inactivity and passivity" to "extreme overactivity and restlessness".

   0 = Extreme inactivity and passivity; placid, sluggish; posture adjustments in chair may be slow and infrequent.
   1 = Little activity; content to sit still most of the time.
   2 = Normal amount of activity; able to sit quietly when interested; may fidget and become restless at times.
   3 = Unusual amount of activity and restlessness; very seldom able to sit quietly.
   4 = Extreme overactivity and restlessness; can't sit still; constantly in motion; activities not in response to specific external stimulation.

12. Nature of Activity - The range is from "extreme rigidity" to "extremely impulsive".

   0 = Extreme rigidity; unable to shift activity or approach to task; cannot vary or adapt responses; stays with one aspect of task.
   1 = Some rigidity; tends to be inflexible in most situations but does shift approach in some instances; at times can change to appropriate response to task.
   2 = Flexible behavioral patterns; activity appropriate to different situations.
   3 = Behavior frequently impulsive; fluid and sometimes uncontrollable.
   4 = Extremely impulsive; explosive and uncontrolled behavior.

13. Nature of Communication - The range is from "little or no verbal communication" to "difficult to follow child's thinking".

0 = Little or no verbal communication; uses gestures and/or pantomime; verbal communication limited to "yes" and "no", or one or two words.
1 = Verbal or nonverbal responses confined to answering directed questions; communication generally elicited rather than initiated by child.
2 = Readily answers questions; may elaborate responses; may initiate conversation; content generally appropriate and easily followed.
3 = Answers questions freely, initially appropriate but tends to lose main idea by elaborations or free associations; at times content seems inappropriate or illogical.
4 = Difficult to follow child's thinking; content usually irrelevant and inappropriate; at times bizarre.

14. Assertiveness - The range is from "extremely assertive, willful personality" to "extreme passivity".

0 = Extremely assertive, willful personality; approach dominating, aggressive and lacking in reserve; attempts to manipulate session, and resists externally imposed limitations.
1 = Quite forceful, unnecessarily rough and careless in handling materials; little inhibited by examiner's presence from doing exactly what he wants; often ignores imposed limits.
2 = Self-assertive but accepting of the situation and capable of control and reserve when demanded; looks for feedback and becomes less assertive; more pliant, when this is indicated.
3 = Passive acceptance; permits self to be somewhat controlled by examiner and situation; rarely shows inclination to want to do something different from what examiner suggests.
4 = Extreme passivity; malleability, and acquiescence to everything, with no trace of resistance; seems extremely over-compliant.

15. Hostility - The range is from "very hostile, obstructive" to "ingratiating child".

0 = Very hostile, obstructive; engages in overt physical or verbal attacks on examiner, test materials or testing room objects; may have tantrums.
1 = Unusual amount of hostility present; very uncooperative and/or becomes angry when restrictions are imposed; may introduce frequent aggressive themes into verbal productions; may want to engage in irrelevant conversation and games, thus indirectly refusing or hindering progress in testing.
2 = No unusual amount of hostility evidenced; negative behavior or affect is generally appropriate and controlled.
3 = Very agreeable child who rarely shows hostility, even where it might be appropriate; never seems to balk at any imposed limitations or react in displeased manner to them.
4 = Ingratiating child; desire to please examiner seems to be the main determinant of behavior.

SECTION X - Behavioral Rating Scales

10.1 Introduction

Behavioral ratings on the hyperactive school-age Ss and their controls were obtained in the following manner: the Conners Parent Questionnaire (PQ) was completed by the mother and father independently at baseline and again at the end of the experimental and control diet periods. The Conners Teacher Questionnaire (TQ) was completed by the child's classroom teacher on the same occasions as just described for the PQ. Finally, the Conners Parent-Teacher Questionnaire (P-TQ), an abbreviated rating scale derived from the PQ and TQ, was completed by the parents and teachers at the end of all intervening weeks throughout the study. The background and development of these scales has been described by Conners (1976). P-TQ and PQ ratings were completed by parents of the hyperactive group and by the parents of a control group (N=10) of nonhyperactive male children selected by teachers on the basis of judged comparability to the experimental S on age, grade placement, and general academic ability. TQ rating data were obtained on 36 control children selected by the classroom teachers of the experimental group according to the same criteria. Results are presented for the P-TQ and TQ ratings for the experimental and control groups below.

10.2 Conners Parent Questionnaire (PQ)

The PQ is a four point, 93 item checklist of common behavioral disorders in children (Conners, 1970). The four point scale has the following rating categories: not at all; just a little; pretty much and very much (Appendix X). A factor analysis of the 93 items (Conners, 1970) yielded eight major factors: Conduct Problem, Anxiety, Impulsive-

Hyperactive, Learning Problems, Psychosomatic, Perfectionism, Anti-social, and Muscular Tension (Appendix X).

10.3 Conners Teacher Questionnaire (TQ)

This rating scale, developed by Conners (1969), is a 39 item questionnaire using the same four point scale described above. The checklist yields five factors: Conduct Problem, Inattentive-Passive, Tension-Anxiety, Hyperactive, and Social Abiiity. The scale includes a judgment of symptom severity and 4 items (five point scale) of global, general improvement (Appendix X).

10.4 Parent-Teacher Questionnaire (P-TQ)

The P-TQ represents an abbreviated form of the PQ and TQ scales and contains 10 items common to both questionnaires. This particular form was designed to minimize the burden of obtaining repeated ratings from parents, teachers, and other observers. The P-TQ has been demonstrated to be highly correlated with the longer questionnaire (Werry, Sprague, and Cohen, 1975) (Appendix X).

10.5 Results

10.51 Conners P-TQ

The weekly mean P-TQ behavioral ratings for baseline and the diet conditions are shown in Figure 10.0. The diet sequence of control-experimental appears to result in lower ratings (i.e., a reduction of hyperactive symptoms) for the experimental diet as compared to the control diet, but comparable lower ratings are not evident in those hyperactive Ss receiving the experimental-control diet sequence. Analysis of the mother, father,

and teacher P-TQ ratings yields a significant diet effect for the parental ratings, but not for the teacher (Table 10.0). The significant Diet x Diet Order interaction indicates that judged improvement was primarily restricted to the control-experimental diet sequence group. The Diet x Diet order interaction was significant for the mothers' and fathers' ratings; indicating the diet order of control diet first, experimental diet second resulted in a decrease in severity of hyperactive symptoms on the experimental diet. Twelve of the 13 children showing a positive response to the experimental diet as indicated by the mother P-TQ ratings were in this diet sequence, as were 11 of the 14 children rated as improved by their fathers. P-TQ ratings for the 10 control Ss are also presented in Table 10.0. Since the mean P-TQ mother, father and teacher ratings across the 10 week observation period were highly similar for the control group, these scores were averaged. The means and standard deviations of the parental and teacher P-TQ ratings for the two diet orders are given in Table 10.1.

Tabulation of the parent and teacher ratings on the Conners P-TQ show that 13 of the 36 mothers of the children in the school-age group rated their sons' behavior as improved on the experimental as compared to the control diet and 6 rated their children as worsened. Seventeen mothers indicated no change (operationally defined as less than 10% change in either direction). Of the 30 fathers of this group, 14 rated their sons as improved, 13 as unchanged, and 3 as worsened. Only 6 of the 36 teachers rated the children as less hyperactive, 10 as worsened, and 20 as unchanged.

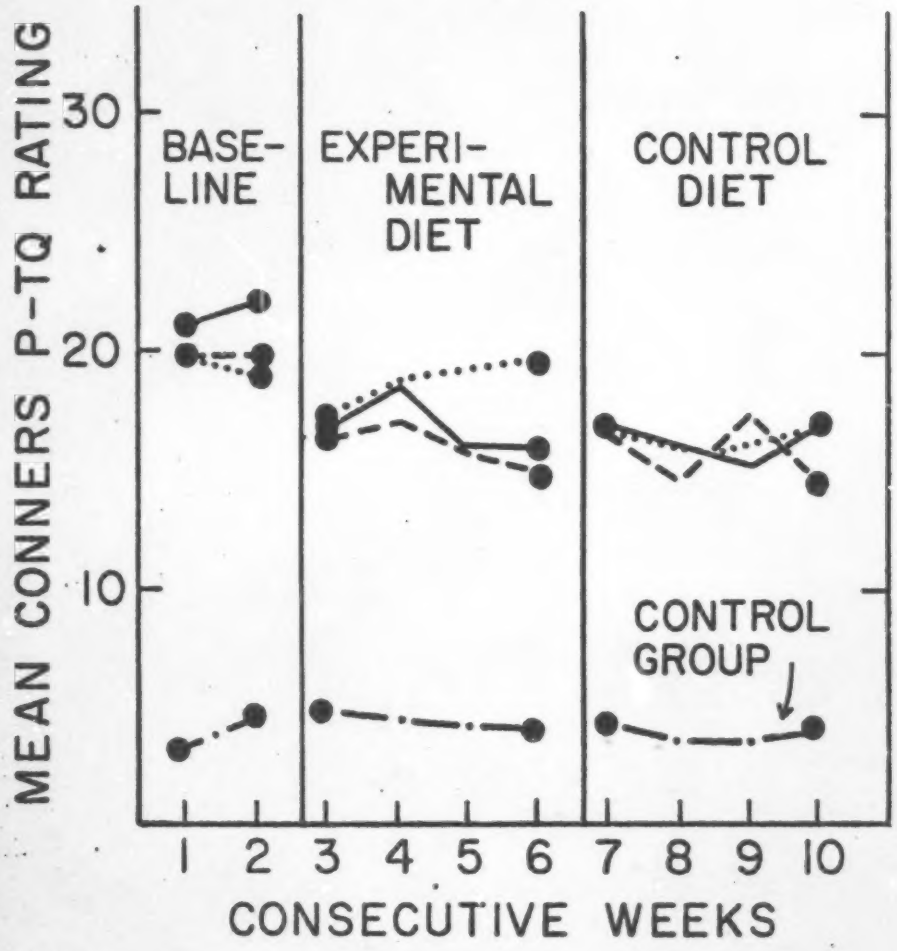
Agreement between the parent and teacher P-TQ ratings was infrequent, with only 4 of the 36 children consistently rated by the parents and teachers as improved on the experimental diet.

10.52 Teacher Questionnaire (TQ)

The 36 hyperactive Ss were significantly different from their matched school-age control Ss on four of the five TQ factor scores at baseline: Conduct Problem, Inattentive-Passive, Hyperactivity, Social Ability, plus judgment on degree of Severity and Total Score (Table 10.2). Ratings for global improvement items of: Academic Achievement, Overall Behavior, Group Participation, and Attitude Toward Authority failed to distinguish the hyperactive and control groups.

A summary of the statistical analyses for the TQ factor scores is presented in Table 10.3. A series of individual 2x2 ANOVAs (Diet x Diet Order) were conducted for the five major factors. No significant effect of the diet manipulation was obtained in these analyses. The remaining items similarly failed to indicate a significant main effect of Diet.

The experimental-control (Table 10.4) and control-experimental (Table 10.5) diet order hyperactive groups were contrasted with the control group for the TQ variables. Both diet order groups were significantly different than the control group for the TQ factors: Conduct Problem, Inattentive-Passive, Hyperactivity and Social Ability. The main effect of testing was significant for the Inattentive-Passive, Hyperactive and Social Ability factors indicating improved ratings from those initially made at baseline for all Ss.



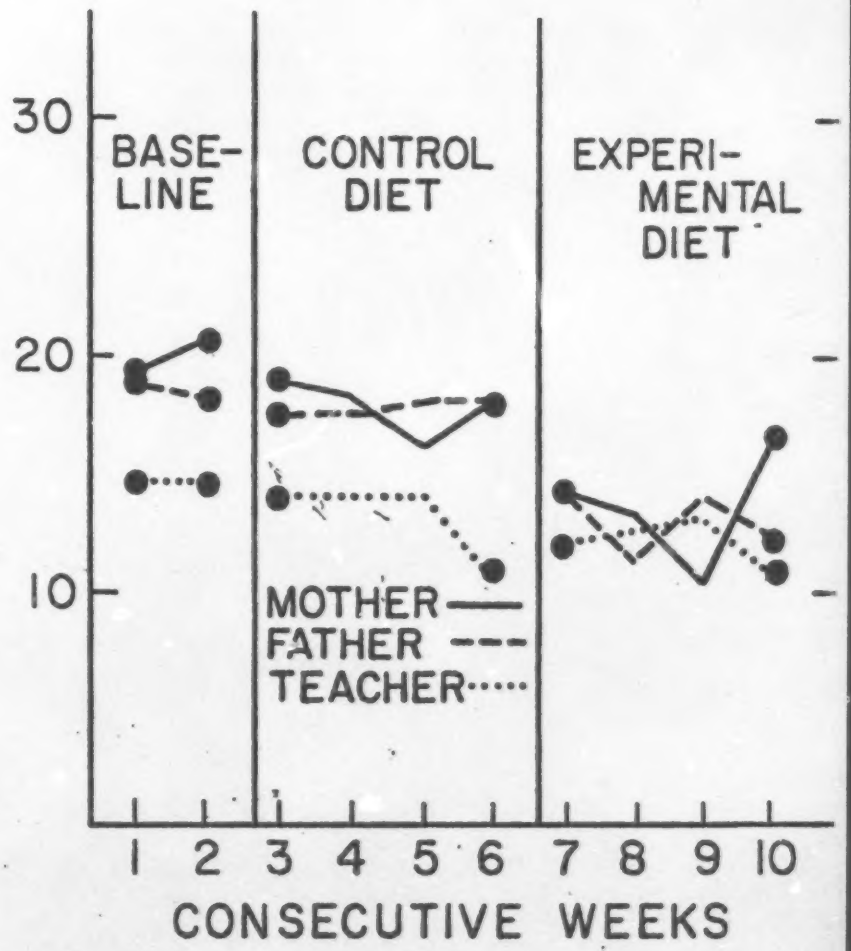


Figure 10.0 Mother, Father and Teacher Conners P-TQ Weekly Ratings for the Two Diet Sequences for the School-Age Hyperactive Subjects and the Average P-TQ Ratings for the 10 Control Subjects.

Table 10.0 Summary Table of the ANOVAs of the Conners Parent-Teacher Questionnaire Scores for the School-Age Hyperactive Subjects

RATER	DIET			DIET ORDER			DIET x DIET ORDER		
	MS	df	F	MS	df	F	MS	df	F
MOTHER	77.99 8.74	1 33	8.92**	8.73 59.84	1 33	<1	83.20 8.74	1 33	9.52**
FATHER	87.48 6.98	1 28	12.53**	.69 55.86	1 28	<1	87.12 6.98	1 28	12.48**
TEACHER	.62 9.06	1 34	<1	293.80 48.84	1 34	6.02*	26.63 9.06	1 34	2.94

*$p < .05$
**$p < .01$

Table 10.1 Means and Standard Deviations of the Conners P-TQ Ratings by Mother, Father and Teacher by Diet Order for the School-Age Hyperactive Group

		DIET ORDER					
		EXP/CNT		CNT/EXP		COMBINED	
		Diet		Diet		Diet	
RATER		EXP	CNT	EXP	CNT	EXP	CNT
MOTHER	$\bar{X}$	16.83	16.61	13.94	18.09	15.32	17.37
	SD	5.24	6.50	6.21	5.33	5.86	5.91
FATHER	$\bar{X}$	16.04	15.87	13.41	18.07	14.63	17.05
	SD	5.17	5.92	6.48	4.67	5.96	5.31
TEACHER	$\bar{X}$	17.98	16.51	12.72	13.68	15.20	15.02
	SD	4.63	5.67	5.59	5.52	5.74	5.69

Table 10.2 Summary of t-Tests of the Conners Teacher Questionnaire Scores for the School-Age Hyperactive Group versus the Matched Controls at Baseline

VARIABLE		GROUP EXPERIMENTAL (N=36)	CONTROL (N=36)	t	p
CONDUCT PROBLEM	$\bar{X}$	1.07	.38	6.34	< .001
	SD	.60	.31		
INATTENTIVE-PASSIVE	$\bar{X}$	1.43	.48	8.47	< .001
	SD	.60	.42		
TENSION-ANXIETY	$\bar{X}$	1.10	1.02	1.07	NS
	SD	.29	.37		
HYPERACTIVITY	$\bar{X}$	1.64	.67	9.21	< .001
	SD	.52	.46		
SOCIAL ABILITY	$\bar{X}$	.92	.25	5.22	< .001
	SD	.74	.41		
SEVERITY	$\bar{X}$	1.90	.43	10.30	< .001
	SD	.68	.64		
TOTAL	$\bar{X}$	42.08	15.03	7.91	< .001
	SD	17.41	12.63		
ACADEMIC ACHIEVEMENT	$\bar{X}$	2.96	2.73	1.64	NS
	SD	.78	.45		
OVERALL BEHAVIOR	$\bar{X}$	3.08	2.88	1.46	NS
	SD	.82	.41		
GROUP PARTICIPATION	$\bar{X}$	3.02	2.86	1.35	NS
	SD	.68	.35		
ATTITUDE TOWARD AUTHORITY	$\bar{X}$	3.04	2.85	1.43	NS
	SD	.77	.38		

Table 10.3 Summary of ANOVAs of the Conners Teacher Questionnaire for Experimental versus Control Diets for the School-Age Hyperactive Subjects

		DIET ORDER			
		EXP/CNT		CNT/EXP	
		Diet		Diet	
VARIABLE		EXP	CNT	EXP	CNT
CONDUCT PROBLEM	$\bar{X}$	1.20	1.09	.98	1.03
	SD	.54	.66	.61	.60
INATTENTIVE-PASSIVE	$\bar{X}$	1.64	1.60	1.19	1.32
	SD	.59	.64	.54	.57
TENSION-ANXIETY[1]	$\bar{X}$	1.12	.98	1.12	1.16
	SD	.36	.26	.29	.25
HYPERACTIVITY[1,2]	$\bar{X}$	1.97	1.74	1.39	1.49
	SD	.40	.52	.48	.52
SOCIAL ABILITY	$\bar{X}$	.90	1.45	.87	.79
	SD	.81	.85	.70	.63
SEVERITY	$\bar{X}$	2.11	2.02	1.72	1.79
	SD	.55	.58	.79	.71
TOTAL[1]	$\bar{X}$	48.67	43.37	37.54	39.57
	SD	15.68	19.38	17.00	16.84
ACADEMIC ACHIEVEMENT	$\bar{X}$	3.00	2.89	3.07	2.89
	SD	.68	.65	.95	.84
OVERALL BEHAVIOR	$\bar{X}$	2.81	2.92	3.28	3.25
	SD	.80	.59	1.03	.76
GROUP PARTICIPATION	$\bar{X}$	2.93	2.91	3.15	3.06
	SD	.51	.66	.83	.71
ATTITUDE TOWARD AUTHORITY	$\bar{X}$	2.91	2.89	3.18	3.14
	SD	.60	.60	.98	.81

[1] Diet x Diet Order $p < .05$

[2] Order $p < .01$

TABLE 10.4 Summary of Conners Teacher [illegible] the Diet Sequence EXP/CNT and for the Control Group

		EXPERIMENTAL (N=17)				CONTROL (N=36)			
		1	2	3		1	2	3	
		BASELINE	EXPERIMENTAL DIET	CONTROL DIET	ACROSS TESTINGS	BASELINE	TEST 2	TEST 3	ACROSS TESTINGS
CONDUCT PROBLEM[1]	$\bar{X}$	1.27	1.09	1.20	1.18	.39	.37	.39	.38
	SD	.66	.66	.54	.62	.35	.29	.33	.32
INATTENTIVE-PASSIVE[1,2]	$\bar{X}$	1.79	1.60	1.64	1.68	.59	.48	.47	.51
	SD	.72	.64	.59	.65	.56	.41	.43	.47
TENSION-ANXIETY	$\bar{X}$	1.01	.98	1.12	1.04	1.01	1.03	1.00	1.01
	SD	.32	.26	.36	.31	.40	.39	.35	.38
HYPERACTIVITY[1,3,4]	$\bar{X}$	2.07	1.74	1.97	1.93	.70	.67	.68	.68
	SD	.45	.52	.40	.47	.53	.44	.48	.48
SOCIAL ABILITY[1,3]	$\bar{X}$	1.03	.90	1.15	1.03	.38	.22	.25	.28
	SD	.83	.81	.85	.82	.49	.37	.41	.43
SEVERITY[1]	$\bar{X}$	2.09	2.02	2.11	2.07	.51	.38	.48	.46
	SD	.78	.58	.55	.63	.71	.51	.75	.66
TOTAL[1]	$\bar{X}$	49.71	43.37	48.67	47.25	16.61	15.01	15.05	15.56
	SD	16.82	19.38	15.68	17.24	15.18	12.11	13.30	13.48
ACADEMIC ACHIEVEMENT	$\bar{X}$	2.97	2.89	3.00	2.95	2.89	2.70	2.77	2.78
	SD	.28	.65	.68	.56	.38	.50	.39	.43
OVERALL BEHAVIOR	$\bar{X}$	3.09	2.81	2.92	2.94	2.94	2.88	2.87	2.90
	SD	.26	.80	.59	.59	.33	.45	.37	.38
GROUP PARTICIPATION	$\bar{X}$	3.12	2.91	2.93	2.99	2.86	2.88	2.84	2.86
	SD	.49	.66	.51	.56	.41	.33	.38	.37
ATTITUDE TOWARD AUTHORITY	$\bar{X}$	3.06	2.89	2.91	2.95	2.87	2.83	2.87	2.86
	SD	.39	.60	.60	.53	.37	.40	.36	.37

[1]Group - Experimental vs Control $p < .001$
[2]Testing - 1 vs 2 vs 3 $p < .01$
[3]Testing - 1 vs 2 vs 3 $p < .05$
[4]Group x Testing Interaction, $p < .01$

the Diet Sequence CNT/EXP and for the Control Group

		EXPERIMENTAL (N=19)				CONTROL (N=36)			
		1	2	3		1	2	3	
		BASELINE	CONTROL DIET	EXPERIMENTAL DIET	ACROSS TESTINGS	BASELINE	TEST 2	TEST 3	ACROSS TESTINGS
CONDUCT PROBLEM[1]	$\bar{X}$	.96	1.03	.98	.99	.39	.37	.39	.38
	SD	.66	.60	.61	.61	.35	.29	.33	.32
INATTENTIVE-PASSIVE[1,2]	$\bar{X}$	1.49	1.32	1.19	1.34	.59	.48	.47	.51
	SD	.56	.57	.54	.56	.56	.41	.43	.47
TENSION-ANXIETY	$\bar{X}$	1.19	1.16	1.12	1.16	1.01	1.03	1.00	1.01
	SD	.34	.25	.29	.29	.40	.39	.35	.38
HYPERACTIVITY[1]	$\bar{X}$	1.52	1.49	1.39	1.47	.70	.67	.68	.68
	SD	.69	.52	.48	.56	.53	.44	.48	.48
SOCIAL ABILITY[1,3]	$\bar{X}$	.89	.79	.87	.85	.38	.22	.25	.28
	SD	.69	.63	.70	.66	.49	.37	.41	.43
SEVERITY[1]	$\bar{X}$	1.61	1.79	1.72	1.70	.51	.38	.48	.46
	SD	.81	.71	.79	.76	.71	.51	.75	.66
TOTAL[1]	$\bar{X}$	40.05	39.57	37.54	39.05	16.61	15.01	15.05	15.56
	SD	19.05	16.84	16.99	17.37	15.18	12.11	13.30	13.48
ACADEMIC ACHIEVEMENT	$\bar{X}$	2.87	2.89	3.07	2.94	2.89	2.70	2.77	2.78
	SD	.72	.84	.95	.83	.38	.50	.39	.43
OVERALL BEHAVIOR[5]	$\bar{X}$	2.97	3.25	3.28	3.17	2.94	2.88	2.87	2.90
	SD	.73	.76	1.03	.85	.33	.45	.37	.38
GROUP PARTICIPATION	$\bar{X}$	2.95	3.06	3.15	3.05	2.86	2.88	2.84	2.86
	SD	.80	.71	.83	.77	.41	.33	.38	.37
ATTITUDE TOWARD AUTHORITY	$\bar{X}$	2.92	3.14	3.18	3.08	2.87	2.83	2.87	2.86
	SD	.73	.81	.98	.84	.37	.40	.36	.37

[1] Group - Experimental vs Control $p < .001$
[2] Testing - 1 vs 2 vs 3 $p < .01$
[3] Testing - 1 vs 2 vs 3 $p < .05$
[4] Group x Testing Interaction, $p < .01$
[5] Group x Testing Interaction, $p < .05$

SECTION X: REFERENCES

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APPENDIX X

CONNERS PARENT QUESTIONNAIRE

ALES 500 TO 998

IENT 5 6 7 8 9
5 6 7 8 9
5 6 7 8 9

TER 5 6 7 8 9
5 6 7 8 9

IOD 5 6 7 8 9
5 6 7 8 9
Weeks 3 Months 4

S YOU WISH TO CHANGE.

INSTRUCTIONS: Listed below are items concerning children's behavior or the problems they sometimes have. Read each item carefully and decide how much you think your child has been bothered by this problem during the last month: NOT AT ALL, JUST A LITTLE, PRETTY MUCH, or VERY MUCH.

Indicate your choice by filling in the space (▬) in the appropriate column to the right of each item.

ANSWER ALL ITEMS.

OBSERVATION			Not at all	Just a little	Pretty much	Very much
PROBLEMS OF EATING:	1. Picky and finicky	1.	0	1	2	3
	2. Will not eat enough	2.	0	1	2	3
	3. Overweight	3.	0	1	2	3
PROBLEMS OF SLEEP:	4. Restless	4.	0	1	2	3
	5. Nightmares	5.	0	1	2	3
	6. Awakens at night	6.	0	1	2	3
	7. Cannot fall asleep	7.	0	1	2	3
FEAR AND WORRIES:	8. Afraid of new situations	8.	0	1	2	3
	9. Afraid of people	9.	0	1	2	3
	10. Afraid of being alone	10.	0	1	2	3
	11. Worries about illness and death	11.	0	1	2	3
MUSCULAR TENSION:	12. Gets stiff and rigid	12.	0	1	2	3
	13. Twitches, jerks, etc.	13.	0	1	2	3
	14. Shakes	14.	0	1	2	3
SPEECH PROBLEMS:	15. Stuttering	15.	0	1	2	3
	16. Hard to understand	16.	0	1	2	3
WETTING:	17. Bed wetting	17.	0	1	2	3
	18. Runs to bathroom	18.	0	1	2	3
BOWEL PROBLEMS:	19. Soiling self	19.	0	1	2	3
	20. Holds back bowel movements	20.	0	1	2	3
COMPLAINS OF FOLLOWING SYMPTOMS EVEN THOUGH DOCTOR CAN FIND NOTHING WRONG:	21. Headaches	21.	0	1	2	3
	22. Stomachaches	22.	0	1	2	3
	23. Vomiting	23.	0	1	2	3
	24. Aches and pains	24.	0	1	2	3
	25. Loose bowels	25.	0	1	2	3
PROBLEMS OF SUCKING, CHEWING or PICKING:	26. Sucks thumb	26.	0	1	2	3
	27. Bites or picks nails	27.	0	1	2	3
	28. Chews on clothes, blankets, or others	28.	0	1	2	3
	29. Picks at things such as hair, clothing, etc.	29.	0	1	2	3
CHILDISH OR IMMATURE:	30. Does not act his age	30.	0	1	2	3
	31. Cries	31.	0	1	2	3
	32. Wants help doing things he should do alone	32.	0	1	2	3
	33. Clings to parents or other adults	33.	0	1	2	3
	34. Baby talk	34.	0	1	2	3
TROUBLE WITH FEELINGS:	35. Keeps anger to himself	35.	0	1	2	3
	36. Lets himself get pushed around by other children	36.	0	1	2	3
	37. Unhappy	37.	0	1	2	3
	38. Carries a chip on his shoulder	38.	0	1	2	3

214

ALTH ADMINISTRATION
MENTAL HEALTH

OMB NO. 68-R965

UESTIONNAIRE

BER MALES 001 TO 499; FEMALES 500 TO 998

PATIENT

RATER (M / F)

PERIOD (Hours / Days / Weeks / Months)

ERASE COMPLETELY ANY MARKS YOU WISH TO CHANGE.

OBSERVATION		Not at all	Just a little	Pretty much	Very much
OVER-ASSERTS HIMSELF:	39. Bullying	0	1	2	3
	40. Bragging and boasting	0	1	2	3
	41. Sassy to grown-ups	0	1	2	3
PROBLEMS MAKING FRIENDS:	42. Shy	0	1	2	3
	43. Afraid they do not like him	0	1	2	3
	44. Feelings easily hurt	0	1	2	3
	45. Has no friends	0	1	2	3
PROBLEMS WITH BROTHERS AND SISTERS:	46. Feels cheated	0	1	2	3
	47. Mean	0	1	2	3
	48. Fights	0	1	2	3
PROBLEMS KEEPING FRIENDS:	49. Disturbs other children	0	1	2	3
	50. Wants to run things	0	1	2	3
	51. Picks on other children	0	1	2	3
RESTLESS:	52. Restless *(overactive)*	0	1	2	3
	53. Excitable, impulsive	0	1	2	3
	54. Fails to finish things he starts *(short attention span)*	0	1	2	3
TEMPER:	55. Temper outbursts, explosive and unpredictable behavior	0	1	2	3
	56. Throws himself around	0	1	2	3
	57. Throws and breaks things	0	1	2	3
	58. Pouts and sulks	0	1	2	3
SEX:	59. Plays with own sex organs	0	1	2	3
	60. Involved in sex play with others	0	1	2	3
	61. Modest about his body	0	1	2	3
PROBLEMS IN SCHOOL:	62. Learning is a problem	0	1	2	3
	63. Does not like to go to school	0	1	2	3
	64. Is afraid to go to school	0	1	2	3
	65. Daydreams	0	1	2	3
	66. Truancy	0	1	2	3
	67. Will not obey school rules	0	1	2	3
LYING:	68. Denies having done wrong	0	1	2	3
	69. Blames others for his mistakes	0	1	2	3
	70. Tells stories which did not happen	0	1	2	3
STEALING:	71. From parents	0	1	2	3
	72. At school	0	1	2	3
	73. From stores and other places	0	1	2	3
FIRE-SETTING:	74. Sets fires	0	1	2	3
	75. Gets into trouble with police	0	1	2	3

	Not at all	Just a little	Pretty much	Very much
1.	0	1	2	3
2.	0	1	2	3
3.	0	1	2	3
4.	0	1	2	3
5.	0	1	2	3
6.	0	1	2	3
7.	0	1	2	3
8.	0	1	2	3
9.	0	1	2	3
10.	0	1	2	3
11.	0	1	2	3
12.	0	1	2	3
13.	0	1	2	3
14.	0	1	2	3
15.	0	1	2	3
16.	0	1	2	3
17.	0	1	2	3
18.	0	1	2	3
19.	0	1	2	3
20.	0	1	2	3
21.	0	1	2	3
22.	0	1	2	3
23.	0	1	2	3
24.	0	1	2	3
25.	0	1	2	3
26.	0	1	2	3
27.	0	1	2	3
28.	0	1	2	3
29.	0	1	2	3
30.	0	1	2	3
31.	0	1	2	3
32.	0	1	2	3
33.	0	1	2	3
34.	0	1	2	3
35.	0	1	2	3
36.	0	1	2	3
37.	0	1	2	3
38.	0	1	2	3

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
NATIONAL INSTITUTE OF MENTAL HEALTH

FORM APPROVED
OMB NO. 68-R965

CONNERS PARENT QUESTIONNAIRE

NUMBER MALES 001 TO 499; FEMALES 500 TO 998

PATIENT: 0 1 2 3 4 5 6 7 8 9

RATER: 0 1 M 2 F 3 4 5 6 7 8 9

PERIOD: 0 1 Hours 2 Days 3 Weeks 4 Months 5 6 7 8 9

SURE TO MAKE MARKS HEAVY AND DARK. ERASE COMPLETELY ANY MARKS YOU WISH TO CHANGE.

	OBSERVATION		Not at all	Just a little	Pretty much	Very much
PERFECTIONISM:	76. Everything must be just so	76.	0	1	2	3
	77. Things must be done same way every time	77.	0	1	2	3
	78. Sets goals too high.	78.	0	1	2	3
ADDITIONAL PROBLEMS:	79. Inattentive, easily distracted	79.	0	1	2	3
	80. Fidgeting	80.	0	1	2	3
	81. Cannot be left alone	81.	0	1	2	3
	82. Climbing; gets into things	82.	0	1	2	3
	83. A very early riser	83.	0	1	2	3
	84. Will run around between mouthfuls at meals	84.	0	1	2	3
	85. Demands must be met immediately —easily frustrated	85.	0	1	2	3
	86. Cannot stand too much excitement	86.	0	1	2	3
	87. Laces and zippers are open	87.	0	1	2	3
	88. Cries	88.	0	1	2	3
	89. Unable to stop a repetitive activity	89.	0	1	2	3
	90. Acts as if driven by a motor	90.	0	1	2	3
	91. Mood changes quickly	91.	0	1	2	3
	92. Poorly aware of surroundings or time of day	92.	0	1	2	3
	93. Clumsy	93.	0	1	2	3

		None	Minor	Moderate	Severe
94. How serious a problem do you think your child has at this time?	94.	0	1	2	3

	Not at all	Just a little	Pretty much	Very much
39.	0	1	2	3
40.	0	1	2	3
41.	0	1	2	3
42.	0	1	2	3
43.	0	1	2	3
44.	0	1	2	3
45.	0	1	2	3
46.	0	1	2	3
47.	0	1	2	3
48.	0	1	2	3
49.	0	1	2	3
50.	0	1	2	3
51.	0	1	2	3
52.	0	1	2	3
53.	0	1	2	3
54.	0	1	2	3
55.	0	1	2	3
56.	0	1	2	3
57.	0	1	2	3
58.	0	1	2	3
59.	0	1	2	3
60.	0	1	2	3
61.	0	1	2	3
62.	0	1	2	3
63.	0	1	2	3
64.	0	1	2	3
65.	0	1	2	3
66.	0	1	2	3
67.	0	1	2	3
68.	0	1	2	3
69.	0	1	2	3
70.	0	1	2	3
71.	0	1	2	3
72.	0	1	2	3
73.	0	1	2	3
74.	0	1	2	3
75.	0	1	2	3

	Not at all	Just a little	Pretty much	Very much
1.	0	1	2	3
2.	0	1	2	3
3.	0	1	2	3
4.	0	1	2	3
5.	0	1	2	3
6.	0	1	2	3
7.	0	1	2	3
8.	0	1	2	3
9	0	1	2	3
10.	0	1	2	3
11	0	1	2	3
12	0	1	2	3
13	0	1	2	3
14.	0	1	2	3
15.	0	1	2	3
16.	0	1	2	3
17.	0	1	2	3
18.	0	1	2	3
19.	0	1	2	3
20.	0	1	2	3
21.	0	1	2	3
22.	0	1	2	3
23.	0	1	2	3
24.	0	1	2	3
25.	0	1	2	3
26.	0	1	2	3
27.	0	1	2	3
28.	0	1	2	3
29.	0	1	2	3
30.	0	1	2	3
31.	0	1	2	3
32.	0	1	2	3
33.	0	1	2	3
34.	0	1	2	3
35.	0	1	2	3
36.	0	1	2	3
37.	0	1	2	3
38.	0	1	2	3

CONNERS PARENT QUESTIONNAIRE

FACTOR COMPOSITION

I. Conduct Problem - 7 Items
- 39-Bullying
- 40-Bragging and boasting
- 41-Sassy to grown-ups
- 47-Mean
- 48-Fights constantly
- 51-Picks on other children
- 69-Blames others for his mistakes

II. Anxiety - 7 Items
- 8-Afraid of new situations
- 9-Afraid of people
- 10-Afraid of being alone
- 11-Worries about illness and death
- 42-Shy
- 43-Afraid they (children) do not like him
- 64-Is afraid to go to school

III. Impulsive-Hyperactive - 8 Items
- 79-Inattentive, easily distracted
- 80-Constantly fidgeting
- 81-Cannot be left alone
- 82-Always climbing
- 83-A very early riser
- 84-Will run around between mouthfuls
- 89-Unable to stop a repetitive activity
- 90-Acts as if driven by a motor

IV. Learning Problem - 4 Items
- 45-Has no friends
- 62-Is not learning
- 63-Does not like to go to school
- 67-Will not obey school rules

V. Psychosomatic - 5 Items
- 6-Awakens at night
- 21-Headaches
- 22-Stomachaches
- 23-Vomiting
- 24-Aches and pains

VI. Perfectionism - 3 Items
- 76-Everything must be just so
- 77-Things must be done same way
- 78-Sets goals too high

VII. Antisocial - 4 Items
- 71-(Stealing) from parents
- 72-(Stealing) from school
- 73-(Stealing) from stores
- 75-Gets into trouble with police

VIII. Muscular Tension - 4 Items
- 12-Gets stiff and rigid
- 13-Twitches, jerks, etc.
- 14-Shakes
- 36-Lets himself get pushed around

$$\text{Factor Score} = \frac{\text{Sum of Composite Items}}{\text{No. of Composite Items}}$$

Factor Score Range = 0-3

Total Score - Sum of 93 Items

Total Score Range = 0-279

ITEMS COMMON TO THE CONNERS P-TQ

- 52-Restless (overactive)
- 53-Excitable, impulsive
- 49-Disturbs other children
- 54-Fails to finish things he starts (short attention span)
- 80-Fidgeting
- 79-Inattentive, distractible
- 85-Demands must be met immediately; frustrated
- 88-Cries
- 91-Mood changes
- 55-Temper outbursts

NOTE: Only 42 items are subsumed under the 8 factors; the other 52 items are not utilized in the factor scoring.

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CONNERS TEACHER QUESTIONNAIRE

PATIENT INITIALS

FIRST INITIAL: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

SECOND INITIAL: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

NUMBER MALES 001 TO 499; FEMALES 500 TO 998

PATIENT: 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

RATER: 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

PERIOD: 0 1 2 3 4 5 6 7 8 9 / 0 1 Hours 2 3 Days 4 5 6 7 Weeks 8 9 / 0 1 2 3 4 Months

PLEASE USE A NO. 2 LEAD PENCIL. BE SURE TO MAKE MARKS HEAVY AND DARK. ERASE COMPLETELY ANY MARKS YOU WISH TO CHANGE.

Listed below are descriptive terms of behavior. Mark in the column which best describes this child. ANSWER ALL ITEMS.

CLASSROOM BEHAVIOR	Not at All	Just a Little	Pretty Much	Very Much
1. Fidgeting	0	1	2	3
2. Hums and makes other odd noises	0	1	2	3
3. Demands must be met immediately; gets frustrated	0	1	2	3
4. Coordination poor	0	1	2	3
5. Restless (overactive)	0	1	2	3
6. Excitable, impulsive	0	1	2	3
7 Inattentive, distractable	0	1	2	3
8. Fails to finish things he starts (short attention span)	0	1	2	3
9. Sensitive to criticism	0	1	2	3
10. Serious or sad	0	1	2	3
11. Daydreams	0	1	2	3
12. Sullen or sulky	0	1	2	3
13. Cries	0	1	2	3
14. Disturbs other children	0	1	2	3
15. Quarrelsome	0	1	2	3
16. Mood changes quickly	0	1	2	3
17. Acts "smart"	0	1	2	3
18. Destructive	0	1	2	3
19. Steals	0	1	2	3
20. Lies	0	1	2	3
21. Temper outbursts (explosive and unpredictable behavior)	0	1	2	3

GROUP PARTICIPATION	Not at All	Just a Little	Pretty Much	Very Much
22. Isolates himself from other children	0	1	2	3
23. Appears to be unaccepted by group	0	1	2	3
24. Appears to be easily led	0	1	2	3
25. No sense of fair play	0	1	2	3
26. Appears to lack leadership	0	1	2	3
27. Does not get along with opposite sex	0	1	2	3
28. Does not get along with same sex	0	1	2	3
29. Teases other children or interferes with their activities	0	1	2	3

ATTITUDE TOWARD AUTHORITY				
30. Submissive	0	1	2	3
31. Defiant	0	1	2	3
32. Impudent	0	1	2	3
33. Shy	0	1	2	3
34. Fearful	0	1	2	3
35. Excessive demands for teachers attention	0	1	2	3
36. Stubborn	0	1	2	3
37. Anxious to please	0	1	2	3
38. Uncooperative	0	1	2	3
39. Attendance problem	0	1	2	3

	None	Mild	Moderate	Severe
40. Considering your total teaching experience with children of this age, how much of a problem is the child at this time?	0	1	2	3

41. What changes have you observed in this child since the start of the study? *(Omit this item at the initial rating)*

	Much Improved	Moderately Improved	No Change	Moderately Worse	Much Worse
Academic Achievement	1	2	3	4	5
Overall Behavior	1	2	3	4	5
Group Participation	1	2	3	4	5
Attitude Toward Authority	1	2	3	4	5

CONNERS TEACHER QUESTIONNAIRE

FACTOR COMPOSITION

I. Conduct Problem - 15 Items
- 12-Sullen or sulky
- 14-Disturbs other children
- 15-Quarrelsome
- 17-Acts "smart"
- 18-Destructive
- 19-Steals
- 20-Lies
- 21-Temper outbursts
- 25-No sense of fair play
- 29-Teases other children
- *30-Submissive
- 31-Defiant
- 32-Impudent
- 36-Stubborn
- 38-Uncooperative

II. Inattentive-Passive - 6 Items
- 4-Coordination poor
- 7-Inattentive
- 8-Fails to finish things
- 11-Daydreams
- 24-Appears to be easily led
- 26-Appears to lack leadership

III. Tension-Anxiety - 7 Items
- 9-Sensitive
- 10-Serious or sad
- 30-Submissive
- 33-Shy
- 34-Fearful
- 37-Anxious to please
- *39-Attendance problem

IV. Hyperactivity - 8 Items
- 1-Fidgeting
- 2-Hums and makes other odd noises
- 5-Restless
- 6-Excitable
- 14-Disturbs other children
- 29-Teases other children
- 35-Excessive demands
- 37-Anxious to please

V. Social Ability - 4 Items
- 22-Isolates himself
- 23-Unaccepted by group
- 27-Does not get along with opposite sex
- 28-Does not get along with same sex

ITEMS COMMON TO THE CONNERS P-TQ

- 5-Restless (overactive)
- 6-Excitable
- 14-Disturbs other children
- 8-Fails to finish things he starts (short attention span)
- 1-Fidgeting
- 7-Inattentive, distractible
- 3-Demands must be met immediately-frustrated
- 13-Cries
- 16-Mood changes quickly
- 21-Temper outbursts

$$\text{Factor Score} = \frac{\text{Sum of Composite Items}}{\text{No. of Composite Items}}$$

Factor Score Range = 0-3

Total Score - Sum of 39 Items

Total Score Range = 0-117

*Items subtracted from factor score.

Note: Only 36 items are subsumed under the 5 factors; the other 3 items are not used in the factor scoring.

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CONNERS PARENT–TEACHER QUESTIONNAIRE

PATIENT INITIALS

FIRST INITIAL: A B C D E F G H I J / K L M N O P Q R S T / U V W X Y Z

SECOND INITIAL: A B C D E F G H I J / K L M N O P Q R S T / U V W X Y Z

NUMBER MALES 001 TO 499; FEMALES 500 TO 998

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RATER: 0 1 M / 0 1 2 F / 2 3 4 5 6 7 8 9 / 0 3 4 5 6 7 8 9

PERIOD: 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 Hours 2 Days 3 Weeks 4 Months

PLEASE USE A NO. 2 LEAD PENCIL. BE SURE TO MAKE MARKS HEAVY AND DARK. ERASE COMPLETELY ANY MARKS YOU WISH TO CHANGE.

INSTRUCTIONS: Listed below are items concerning children's behavior or the problems they sometimes have. Read each item carefully and decide how much you think this child has been bothered by this problem *at this time:* NOT AT ALL, JUST A LITTLE, PRETTY MUCH, or VERY MUCH. Indicate your choice by filling in the space (▬) in the appropriate column to the right of each item.

ANSWER ALL ITEMS

	Not at All	Just a Little	Pretty Much	Very Much
1. Restless (overactive)	0	1	2	3
2. Excitable, impulsive	0	1	2	3
3. Disturbs other children	0	1	2	3
4. Fails to finish things he starts (short attention span)	0	1	2	3
5. Fidgeting	0	1	2	3
6. Inattentive, distractable	0	1	2	3
7. Demands must be met immediately; frustrated	0	1	2	3
8. Cries	0	1	2	3
9. Mood changes quickly	0	1	2	3
10. Temper outbursts (explosive and unpredictable behavior)	0	1	2	3

	None	Minor	Moderate	Severe
How serious a problem do you think this child has at this time?	0	1	2	3

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SECTION XI - Preschool Sample

11.1 Introduction

Ten preschool boys between the ages of 3 years, 0 months and 5 years, 11 months ($\bar{X}$ = 56 months, SD = 13.6) were studied during the summer of 1975. The demographic and neuro-physical examinations are described in Sections III and IV, respectively. The mean P-TQ selection ratings of the preschool sample are shown in Table 11.0.

11.2 Results

11.21 Neuropsychological Variables

The means and standard deviations of the neuropsychological variables for baseline, experimental and control diets are presented in Table 11.1. Neither visual inspection of these data nor preliminary statistical analyses suggests clinically or statistically significant differences between the experimental and control diets.

11.22 Behavioral Ratings

The weekly mean P-TQ ratings are shown separately for the experimental-control diet (Figure 11.0) and control-experimental (Figure 11.1) diet sequences. As can be seen in Figure 11.0, the mother and father P-TQ ratings are relatively consistent with each other, but the P-TQ scores did not appear to be strikingly different between the experimental and control diet conditions. In contrast, Figure 11.1 shows relatively consistent high ratings over baseline and the three weeks of the control diet. A significant decrease in P-TQ ratings (improved behavior) is shown for the last

three weeks of the study when the hyperactive Ss were maintained in the experimental diet regime.

Analysis of variance of the mother's P-TQ ratings yielded a significant main effect of Diet [F (1,8)=5.48, p <.05], regardless of diet order [F (1,8)=1.32, p >.05]. The smaller number of father ratings available precluded comparable statistical analysis.

Inspection of Table 11.2 indicates that the diet sequence of control diet first, experimental diet second resulted in greater improvement (lower P-TQ scores) on the experimental diet than for the hyperactive Ss receiving the reverse diet sequence.

11.23 Laboratory Observations

The locomotor activity of the same 10 subjects was observed in a standard laboratory setting at the end of the baseline and of each dietary interval. The frequency of movement varied considerably within the sample and across diet periods, but in contrast to the parental ratings, no significant decrease in activity level attributable to the experimental diet was observed.

11.3 Summary

The preschool parental rating data are certainly of considerable interest and potential significance. However, the small sample size, the absence of teacher ratings and the failure to find corresponding diet-related improvement in the laboratory observation situation or on neuropsychological measures necessarily impose interpretative constraints on the significance of the subjective parental ratings.

Table 11.0 Preschool Age Sample P-TQ Selection Criteria

DIET ORDER	CONNERS P-TQ	
	$\bar{X}$	SD
CONTROL-EXP (N=5)	21.40	2.97
EXP-CONTROL (N=5)	24.2	3.90

Table 11.1 Summary of Neuropsychological Tests for Preschool Age Hyperactive Subjects for Baseline, Experimental and Control Diet Conditions

			DIET	
		BASELINE	EXPERIMENTAL	CONTROL
WRAT				
Reading	$\bar{X}$	.97	1.01	.99
	SD	.48	.31	.34
Spelling	$\bar{X}$	.51	.56	.65
	SD	.27	.37	.26
Arithmetic	$\bar{X}$	.81	.71	.81
	SD	.27	.28	.42
FINGER TAPPING				
Dominant Hand	$\bar{X}$	26.25	24.00	28.00
	SD	9.01	7.63	6.50
Nondominant Hand	$\bar{X}$	23.75	23.62	25.77
	SD	5.39	3.96	4.94
PEGBOARD				
Dominant Hand	$\bar{X}$	70.10	65.11	71.40
	SD	28.33	30.34	34.73
Nondominant Hand	$\bar{X}$	71.50	67.55	71.44
	SD	38.47	33.85	37.77
STATIC STEADINESS				
Dominant Hand - Time	$\bar{X}$	13.78	15.73	13.41
	SD	8.80	5.46	3.79
Nondominant Hand - Time	$\bar{X}$	22.93	23.51	19.88
	SD	8.22	6.65	4.34
KNOX CUBES	$\bar{X}$	6.00	5.44	5.25
	SD	2.47	1.49	1.10
PORTEUS MAZE				
Qualitative Score	$\bar{X}$	91.57	106.75	109.50
	SD	10.45	9.13	10.41

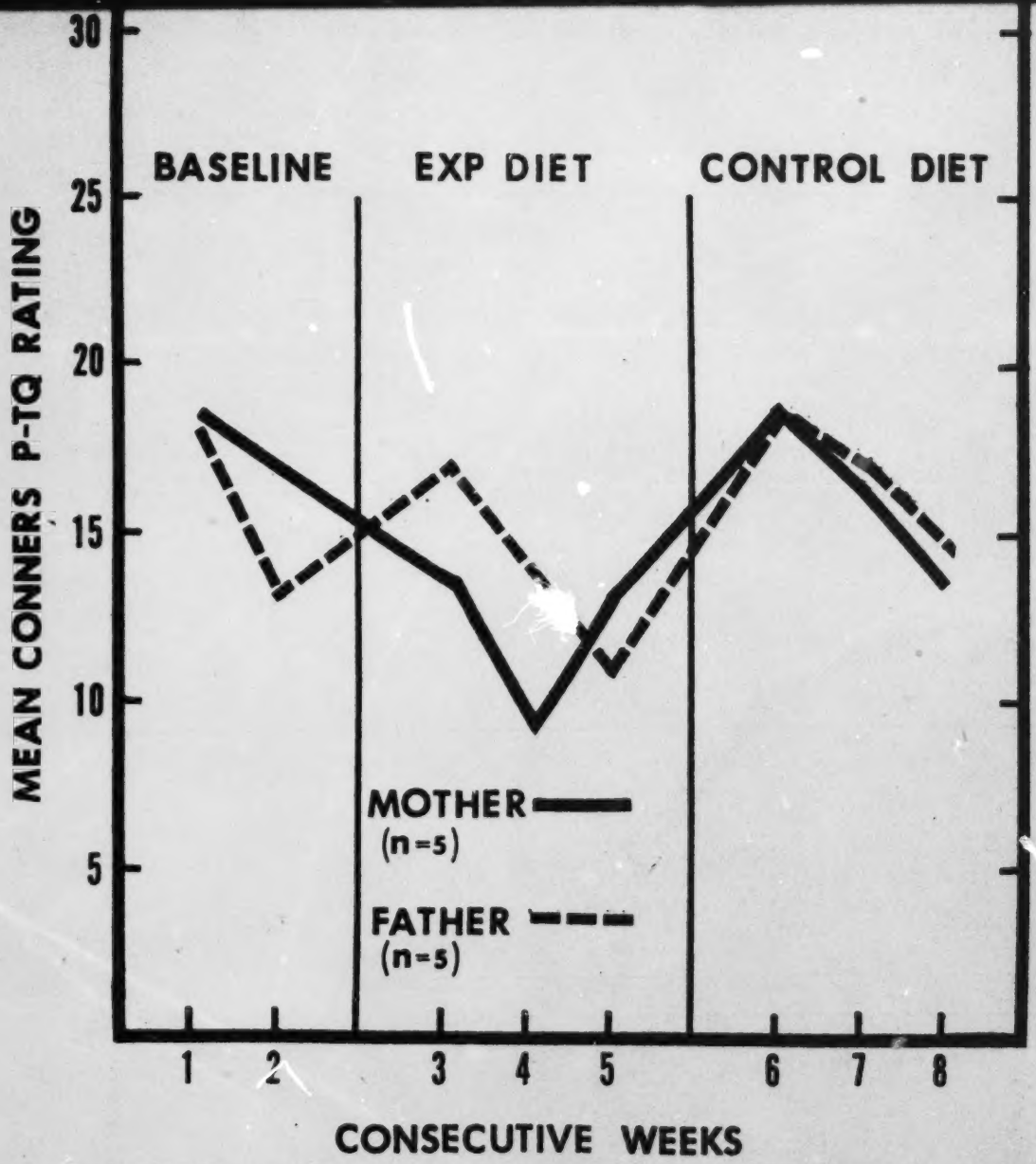

Figure 11.0 Mother and Father P-TQ Weekly Ratings for the Experimental-Control Diet Sequence for Preschool Age Hyperactive Subjects

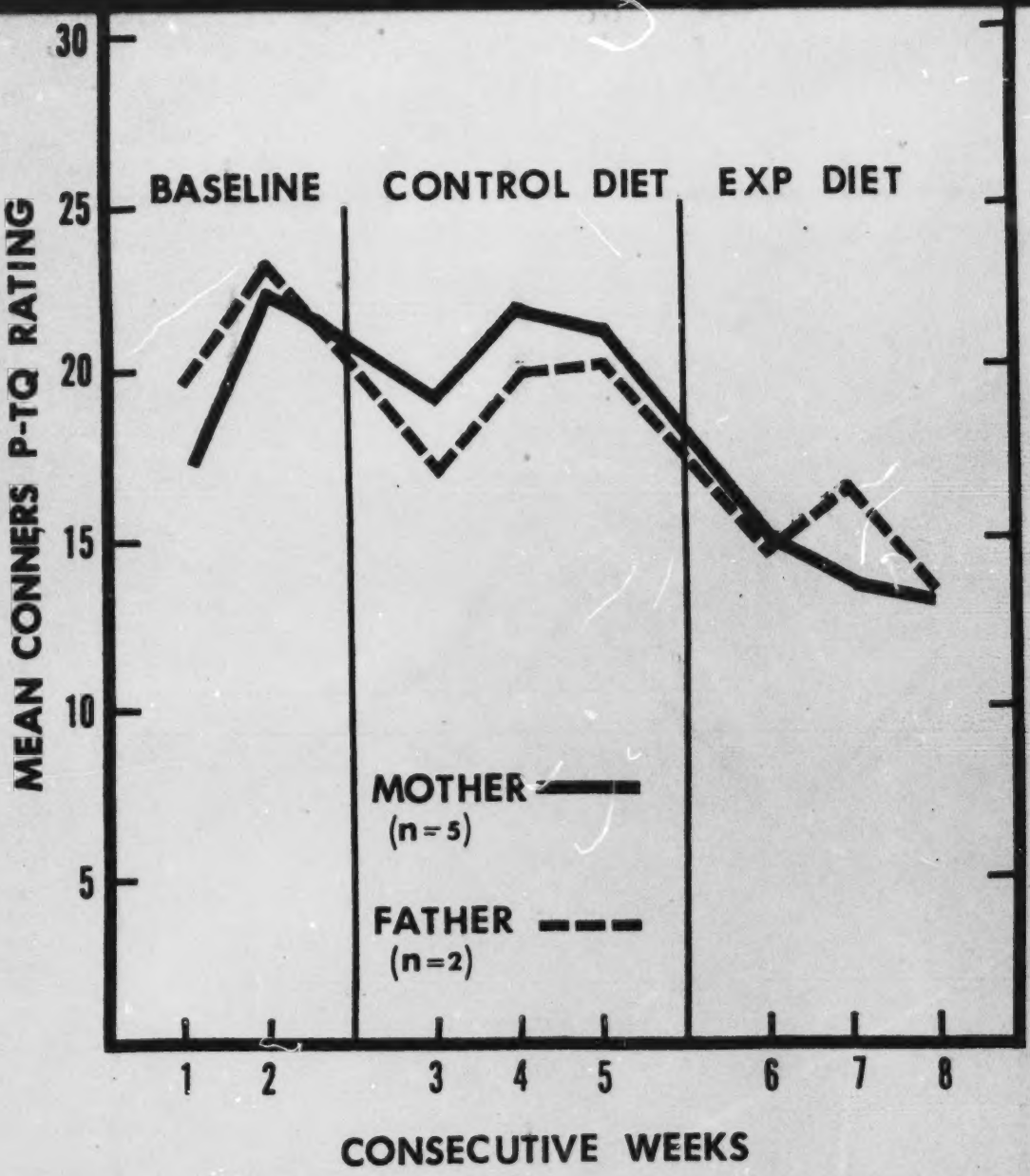

Figure 11.1 Mother and Father P-TQ Weekly Ratings for the Control-Experimental Diet Sequence for Preschool Age Hyperactive Subjects

Table 11.2 Summary of Mother and Father P-TQ Ratings for Experimental and Control Diet Conditions by Diet Order for the Preschool Age Sample

		DIET ORDER			
		EXP/CNT DIET		CNT/EXP DIET	
RATER		EXP	CNT	EXP	CNT
Mother	$\bar{X}$	11.27	14.60	14.13	20.93
	SD	2.93	5.94	4.07	2.74
Father	$\bar{X}$	14.27	14.87	14.83	19.16
	SD	5.59	7.77	1.18	2.13